Railway March 1945
Mechanical Engineer

## Proteslading WINE) DROP ENDLOGK

MAR 14 1945

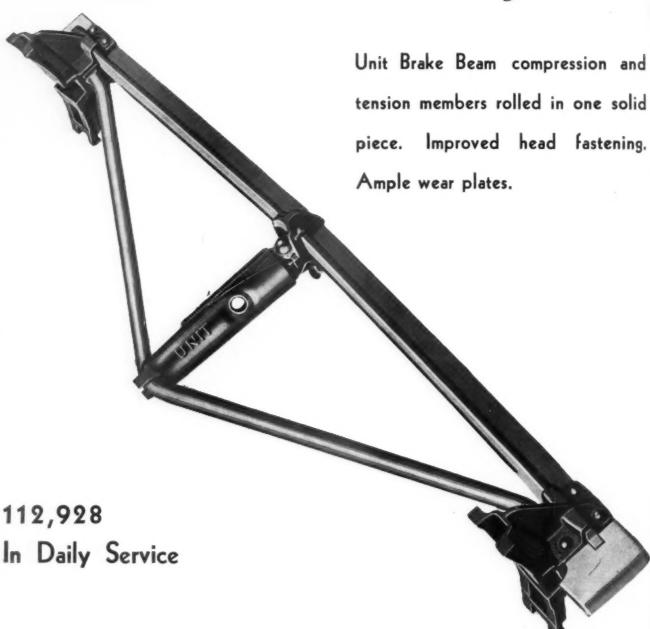
OR ALL ROP END

ONDOLA CARS

THE WINE RAILWAY APPLIANCE CO.

## UNIT TRUCK

Simplicity



UNIT TRUCK CORPORATION

140 CEDAR STREET

NEW YORK. 6, N. Y.





When you shop locomotives for Class B overhaul, removal of heavy muck and grease from running gear is a preliminary step which puts surfaces in the clean condition that facilitates inspection and assists mechanics in completing their work far more easily and on schedule. Fast, low-cost Oakite Steam-Detergent cleaning provides today's best answer for saving time on this job as it does for removing caked-on grime from freight and passenger car trucks prior to repair and painting. Where manpower is short, Mechanical Supervisors are finding the Oakite Model No. 385 Steam Gun, shown at left, an essential war tool that speeds maintenance and repair. Specifications, price and operating data are yours for the asking.

### Tank Cars Cleaned in Half the Time With Model 324 Tank Car Unit

You can expedite the movement of tank cars, particularly where it is necessary to clean interiors when heavy oils are replaced by gasoline, or when changing from one product to another, by using the Oakite Interior Tank Car Cleaning Unit, Model No. 324. This carefully engineered device eliminates steaming-out time, cleans interior surfaces quickly, thoroughly, safely . . . does it at low cost . . . usually cuts in half the time previously required for this work. Details of this unit gladly forwarded to railroad executives on request.

OAKITE PRODUCTS, INC., WRIGLEY BUILDING, CHICAGO II, ILL.

In Canada: OAKITE PRODUCTS OF CANADA, LTD.

TORONTO: 65 Front St. East-MONTREAL: 1 Van Horne Ave.

OAKITE RAILWAY SERVICE DIVISION

## AMERICA'S NEWEST STEAM

America's first direct-drive steam turbine locomotive, built by Baldwin with turbines and gears by Westinghouse.

> There is nothing static about locomotive design and construction and this goes for all types-steam, diesel-electric, electric, and others

The new and improved locomotives now coming from the Baldwin and the railroads is taking care of that. shops are tangible evidence of this constant progress in the locomotive

Our engineering staff will welcome the opportunity to study your

York, Chicago, Washington, Boston, Cleveland, Detroit, St. Louis,

ALDWIN SERVES THE NATION WHICH THE RAILROADS HELPED

### AND DIESEL LOCOMOTIVES



Four-cylinder Duplex locomotive, offering improved performance at all speeds with outstanding advantages at high speeds.

> Baldwin-Westinghouse, 2000hp. diesel-electric locomotive the newest thing in the diesel field for main line service.

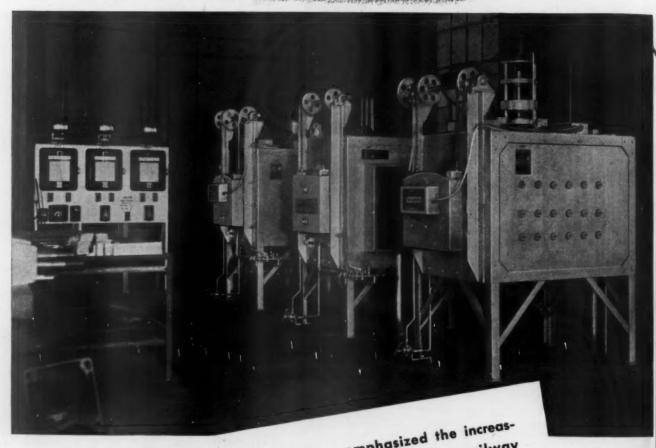


LOCOMOTIVES

BALDWIN PRODUCTS FOR THE RAILROADS — Steam, diesel-electric and electric locomotives, Diesel engines, Hydraulic presses, Special railroad shop equipment, Testing machines and instruments, Steel tires and rolled steel wheels, Crane wheels, Connecting reds and other steel forgings, Steel castings, Springs, Motal plate fabrication, Beilers, Non-ferrous castings, Bending rolls, Flate planers, Dynamometer cars



## For Pas Maintenance Brograms

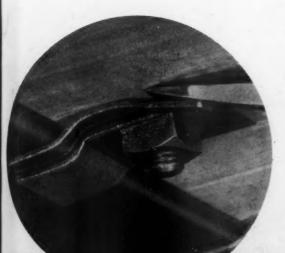


Man power shortages have emphasized the increasing need for modern efficient equipment in railway maintenance shops. Heat Treating furnaces are important factors in speeding production of repair parts and should have primary consideration in any modernizing program. Illustrated is a new Railroad installation of Hevi Duty Furnaces at Aurora, Illinois, used for hardening of Furnaces at Aurora, Illinois, used for hardening of carbon locomotive shop tools and heat treating of carbon and high speed tool steels. There is a Hevi Duty type and size to fit your particular needs — send for bulletins.

### HEVI DUTY ELECTRIC COMPANY

MILWAUX E.F. THE STREET STREET STREET

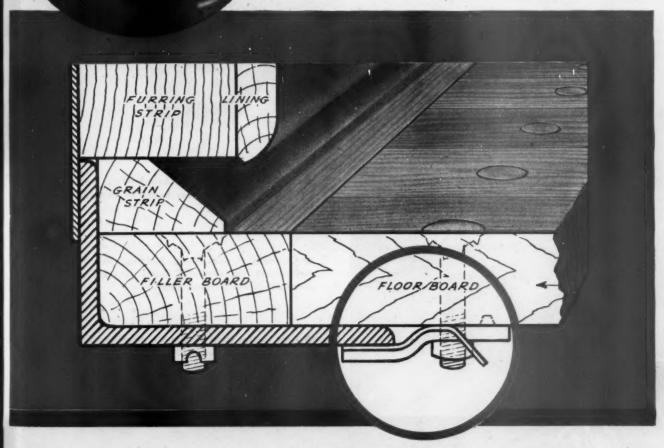
## Short floor boards lower floor repair costs



When repairing box car floors, grain strips and bottom lining boards do not have to be removed if the car has "short floor boards."

Short floor board construction is made possible by using the long leg of the side sill horizontal and fastening floor boards with "M-F" Lock-Tight Floor Clips. This permits the boards to be fastened at any point on the sill... and also permits them to be removed at any point... without hindrance from the grain strip or side lining.

Short floor board construction with "M-F" Lock-Tight Floor Clips lowers ultimate costs.

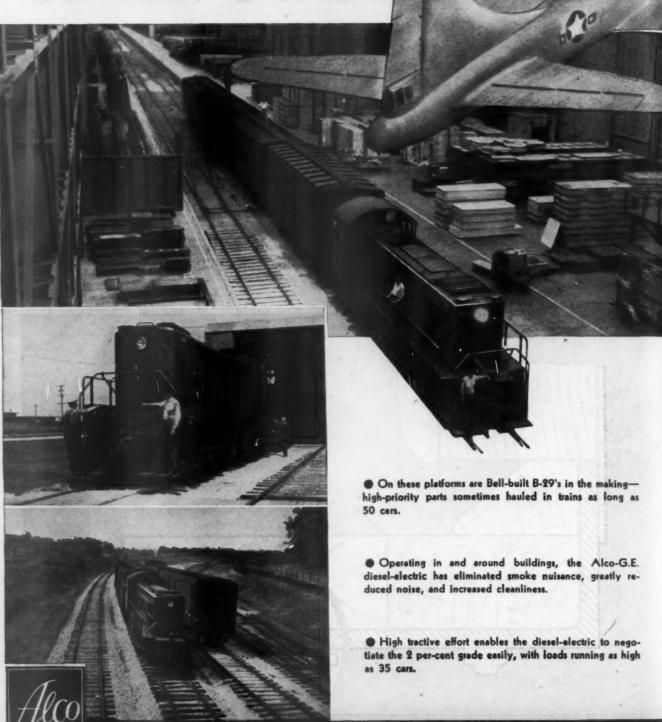


MACLEAN-FOGG LOCK NUT COMPANY

2649 N. Kildare Avenue, Chicago 39, Illinois . In Canada: The Holden Co., Ltd., Montreal

March, 1945

## Alco-G.E. diesel-electric helps SPEED PRODUCTION



(ge)

AMERICAN LOCOMOTIVE

### of B-29 SUPERFORTS



Don J. Finnegan

"Our Alco-G.E. diesel-electric locomotive has greatly speeded up handling of all freight. In 16 months there has never been any interruption of service for maintenance."

Don J. Finnegan, Traffic Manager Bell Aircraft Corporation Marietta, Georgia

THE Bellcraft Railroad is operated by the Bell Aircraft Corporation. It is only two years old, and only eight miles long. But it's a "hot" stretch of track. In 16 months, back of a 1000-hp Alco-G.E. diesel-electric, more than two million tons of most vital materials have sped over it—materials to build the Bell B-29 plant at Marietta, and to construct the great Superfortresses themselves.

The diesel-electric is needed 16 hours a day to keep production rolling swiftly and smoothly. And it's available every minute of those 16 hours. The remaining eight hours are more than ample to take care of all inspections, refueling, and maintenance.

It handles all road work and all switching, both in the yard and in the buildings. Over track that includes a 2 per-cent grade for 1000 yards, 6330 cars were handled in two months, or 211 cars a day, seven days a week. This Alco-G.E. unit has replaced two steamers. Its high availability, high tractive effort, and fast acceleration enables it to get more work done in less time and at lower cost.

Fuel costs are low, and no special ash-handling or watering facilities are required. Maintenance is negligible. On many roads diesel-electric savings permit writing off the investment in two to three years.

We build all three types of motive power-

diesel-electric, electric, and steam. Whether your problem is meeting the wartime or peacetime requirements of your customers, Alco-G.E. is in a position to recommend impartially the type of motive power economically best fitted to do each job.

### IN SERVICE

Since those pioneering days in the early twenties when Alco and G.E. built the first "oil-electrics," railroads have placed 1000 Alco-G.E. diesel-electrics in service, totaling more than 1,000,000 horsepower. In our laboratories and factories, the cream of motive-power engineering talent is preparing new and improved locomotive designs that will greatly strengthen your competitive position in the years that are ahead.

and GENERAL ELECTRIC

### ANOTHER TYPICAL ENGINEERED REBUILDING JOB

NOTHER TYPICAL ENGINEERED REBUILDING JOB
PRODUCTION LIST Office COMMONS
PRODUCTION OF THE PRODUCT OF THE PRO
TAPE INTERPRETATION OF THE PROPERTY OF THE PRO
DESCRIPTION
Plana Red, Scrape & Prost    Description   Plana Red   Scrape & Pit
2 Machine Toolslides
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Machine Trol Slide  Pit weld Broken Tool Slide  Meld Broken Tool Slide  Mew Tool Plates For Tool Slide  New Tool Plates For Tool Slide  See Tool Plates For Tool Slide
6 New York Tellsmith
E INTERNATION OF MOTOR
11 Chack Bydraul Tool 9110e
13 New Gibs For Needed New Gara Where Needed
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by Cualum sot chuck sur
SIMMONS MACHINE TOOL CORPORATION 1825 NORTH BROADWAY, ALBANY I, NEW YORK

MANUFACTURERS OF STANDARD AND SPECIAL-PURPOSE MACHINE TOOLS . ENGINEERED REBUILDING SIMMONS

LOCOMOTIVE

## RELIANCE

### SPRING WASHERS

will eliminate troublesome looseness on 50 or more important Engine bolts.

Operating schedules today strain every motive power unit to the limit. There is less time and labor for maintenance of equipment. The problem of keeping locomotive bolts tight requires a surprising number of shoppings for servicing. You can reduce these round-house hours and keep locomotives rolling longer with Reliance Locomotive Hy-Crome Spring Washers made to exacting specifications for each bolt size. The Ground Deflection provides parts protection.

Write wolf for the six-page folder on "Reliance Hy-Crome Spring Washers for Motive Power," You may also secure a list of important engine bolt applications for Locomotive Hy-Cromes, helpful in avoiding southy shopping hours.

EATON MANUFACTURING COMPANY
RELIANCE DIVISION MASSILLON, OHIO
Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal



## Just try to wash even a toy train by hand in five minutes ... yet this Whiting washer scrubs full-sized cars at the rate of 300 per day



Chicago & North Western Railway portable installation for washing streamlined Diesel-electric locomotives and coaches. Note spray guards and short brushes for cleaning windows.

Photo courtsey of Chicago & North Western Railway

Working by hand, you can't wash even a toy train thoroughly in five minutes—yet Whiting car washers, averaging a speed of 80 feet a minute, wash 300 coaches in an eighthour working day. Saving up to 75% in time and labor, Whiting washers more than cut washing costs in half.

Equipped with self-aligning brushes that compensate for car tilt, Whiting installations assure efficient cleaning. Reversible brushes on many models permit cars to be run through from either end without delay. Car finish is protected by the use of water only or—for extremely dirty cars—cleaning solution sprays with a carefully-timed water rinse.

One- and two-unit installations are available for use with streamlined Diesel-electric locomotives, coaches, tenders, buses, trackless trolleys, etc. Write for information.

Offices in Chicago, Cincinnati, Detroit. Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, and Washington, D. C. Agents in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Teronto, Ontario.

### WHITING

15609 Lathrop Avenue, Harvey, Illinois

DROP PIT TABLES . LOCOMOTIVE HOISTS . HIGH-LIFT JACKS . LOCOMOTIVE SPOTTERS CINDER CONVEYORS . TRANSFER TABLES . CROSSOVER BRIDGES . CAR WASHERS



### QUICK-ACTING BUSHING PRESS

Speeds

Many Forcing Jobs



Bulletin 520-A is one of a new series of bulletins on railroad shop equipment. It gives complete details and specifications of various sizes and capacities of standard W-S Bushing Presses. For your copy... and for other bulletins on W-S railroad shop equipment... write to the Watson-Stillman Co., Roselle, N. J.

Many repair shops and railroad equipment builders use this W-S Hydraulic Press for quick, precise handling of various forcing jobs. Major operations handled efficiently are — inserting and removing connecting rod bushings and driving box brasses... bending and straightening rods, levers, and similar connections.

The Watson-Stillman Bushing Press is self-contained, quickacting and oil-operated. Power is supplied by a combination low and high pressure rotary oil pump, which produces rapid traverse speeds to and from the work. Hydraulic power unit and circuit design provide smooth, shockless, press operation and pulsationless pressure application with single lever control.

Pumping unit, valve control and piping are located on top of the press, thus facilitating the introduction of work into the press. Simple design reduces maintenance costs; there are no poppet valves, seats, pump plungers, or valve stuffing-box packings to require attention. Press is equipped with plain or "U" slotted bed. The Watson-Stillman Co., Roselle, N. J.

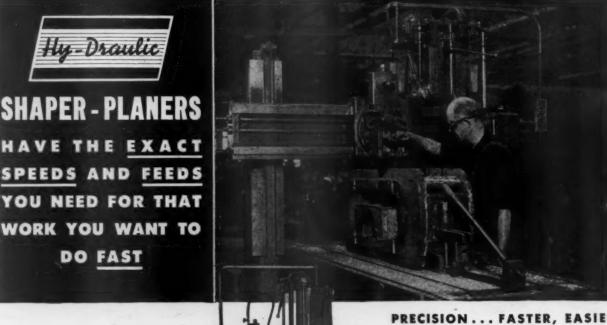
### WATSON-STILLMAN

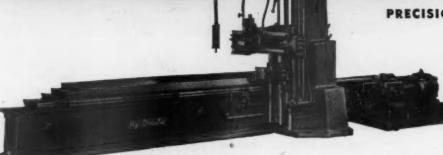
Designers and Manufacturers of Hydraulic Equipment, Forged Steel Fittings and Valves

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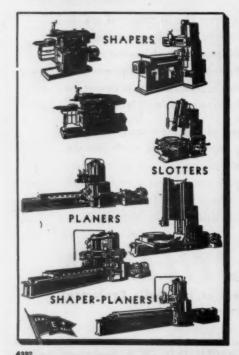


DO FAST





Hy-Draulic Shaper-Planer redriving conditioning main boxes in which worn shoe and wedge faces have been built up by electric welding. Formerly a job for larger machines, this work is now done on the Hy-Draulic Shaper-Planer with equal accuracy, greater ease; and some 25% faster.



War emphasizes importance of features and advantages in Hy-Draulic Shaper-Planers that proved themselves so useful in peace-time railroad work. For example, Hy-Draulic drives make it easy for operators to get the exact combinations of speed and feed needed to do work fast. They maintain cutting pressure steadily at uniform speed throughout each chip, return the table "on the double" for the next. Hy-Draulic Shaper-Planers are simple to set-up. Their tooling costs little. Their easy operation saves time, horsepower and manpower. Womanpower? Could be.

When getting rolling stock back on the rails fast requires any of a certain wide range in shaping and planing operations, you can't beat the Hy-Draulic Shaper-Planer. Investigate. Inquire, also, about the notable advantages available in Hy-

BUY UNITED STATES Draulic Slotters, Planers, and Shapers. / There has never been a better time to buy Hy-Draulic Machine Tools for railroad work. Write today for details of Hy-Draulic features and advantages. Just mention the Hy-Draulic Machine Tools you can use, and ask for Bulletin 1917.



### Automatically end-weld studs!

- Complete fusion between stud and metal in ½ second . . . Saves time.
- No drilling holes or hand-welding bolts.

  Studs are pointed for accurate locating.
- One operator can weld more than 1000 studs per shift. Completely portable. Also available as a production jig.
- Thousands of guns now being used in more than 500 shipyards and industrial plants.



## NELSON ELECTRIC ARC STUD WELDERS



End-welding a stud to metal plate.

Dept. R, 440 Peralta Avenue, San Leandre, Calif.

Eastern Representative: Camden Stud Welding Corp. Dept. 122, 1416 South 6th Street, Camden, N. J.







## 847 Less Time Required To Bore These Tapered Roller Seats

### G.& L. Horizontal Boring Machine Equipped With Special Taper Boring Tool Saves \$56.00 on Each Part...Costly Holding Fixture Unnecessary

• Machining time on this landing craft component was cut from 12 hours to 2 hours by using a G. & L. Horizontal Machine equipped with a special taper boring tool. Cost of boring the tapered recesses was \$67.00 per part. Reduction in machining time saves \$56.00 on each component. These savings are a direct result of the flexibility of the G. & L. machine and the special taper boring tool.

Each recess is bored separately. The taper boring tool

No. 340-T Giddings & Lewis Horizontal Boring, Drilling and Milling Machine.

There is a size and type Giddings & Lewis Horizontal Boring, Drilling and Milling Machine that can be selected to fit your work requirements. In addition, Giddings & Lewis manufacture a complete line of accessories and attachments which may be used on this machine to reduce overall machining costs on specific work. These attachments and accessories include: the Continuous Feed Facing Head, angular milling attachments, plain and power driven rotary tables and many others. When used with the G. & L. Horizontal they effect material savings in machining large, unwieldy work.

has a sliding tool holder set at an angle and is arranged for a cutting tool to be mounted on each end. When one taper bore is completed in the steel casting, the cutting tool is removed and the opposite tool is set to recess the opposite bore. As the machine spindle is fed out, a connecting link in the taper boring head engages the sliding tool holder and moves it in its guide to form the taper.

Formerly it was necessary to mount the part in a costly holding fixture on another type machine. It is now mounted on the machine table and requires no fixture. This is an excellent example showing the simplicity and ease of mounting work on the G. & L. Horizontal and also the flexibility of the machine in performing unusual operations.

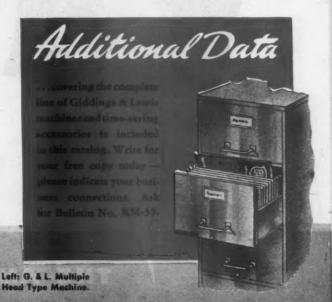
Many manufacturers confronted with similar jobs are using their G. & L. Boring Machines to reduce production costs. Sometimes it is necessary to use accessory equipment such as this taper boring tool, but in most cases the machine is readily adapted to practically any type of work. In those instances where machining problems are difficult, G. & L. engineers will gladly help solve such problems. There is no obligation for this assistance.





Left: G. & L. Planer Type Machine.



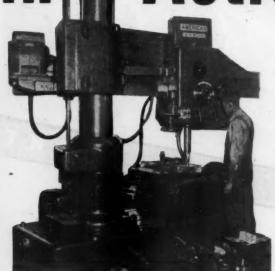


'AMERICANS"



THE AMERICAN TOOL WORKS CO.

## in Action...

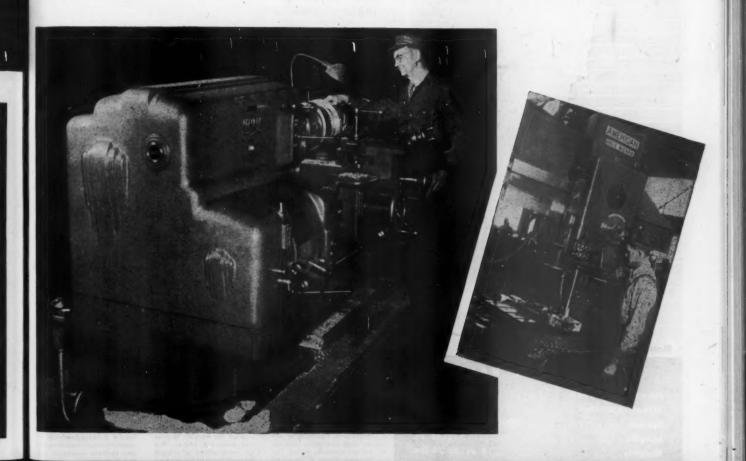


In the most prominent railroad shops "American" Lathes and "American" Radial Drills are on the job helping to keep the wheels turning.

"Americans" have been selected by many because they have proven themselves to be sound investments. Their designs are modern but free from the complications so often encountered in the modernization of machine tools. They emphasize in their designs the three factors which dominate the cost of producing work, namely, high power input, structural ruggedness and ease of operation. As a result they have a high productive capacity with a low replacement and maintenance cost.

We are convinced that railroad shops are best served by this type of equipment.

Literature will be sent gladly upon request.



co Lathes and Radial Drills Cincinnati, Ohio U.S.A.

## modern alhor

HELP MAKE

### Save Time on Grinding Jobs

The advanced construction features of Thor Air Grinders mean top speed—peak efficiency—maximum power—light weight and extra stamina for the toughest jobs:

- 1. THOR "Air Behind the Blades" principle keeps the rotor blades out against the cylinder bushing wall, preventing dead center positions and assuring instant starting under all operating conditions.
- 2. The solid one piece construction of the THOR rotor permits the use of deeper blade slots and wider blades. This greatly boosts the power and the rate of material removal.
- 3. The THOR Double-Acting Safety Governor acts to save time in two ways: It regulates spindle speed to the level of highest grinding efficiency for the size and type of wheel used. It prevents racing of wheels at dangerously high speeds even in event of mechanical failure of governor parts.

You will find these top speed construction features, plus others like THOR End Exhaust, Automatic Lubrication, and Labyrinth Seal on Spindle, in a complete line of THOR Air Grinders for every industrial application. For details, write for THOR Pneumatic Catalog No. 52B.

A STYLE TO MEET YOUR NEEDS

### LOOK AT THE RANGE

 Number of models
 50

 Wheel capacities
 1½" to 8" dia.

 Speeds
 3000 to 21,000 r.p.m.

 Lengths
 5½" to 39"

 Weights
 18 oz. to 24 lbs.



attraight Intertige—the straight theotife permits a constant flow of air into the tool without the necessity of keeping the laws continually depressed. The machine will, not stop operating until the valve is manually closed. For graders up to 4" capacity wirried wheels, it is the most widely used handle type.

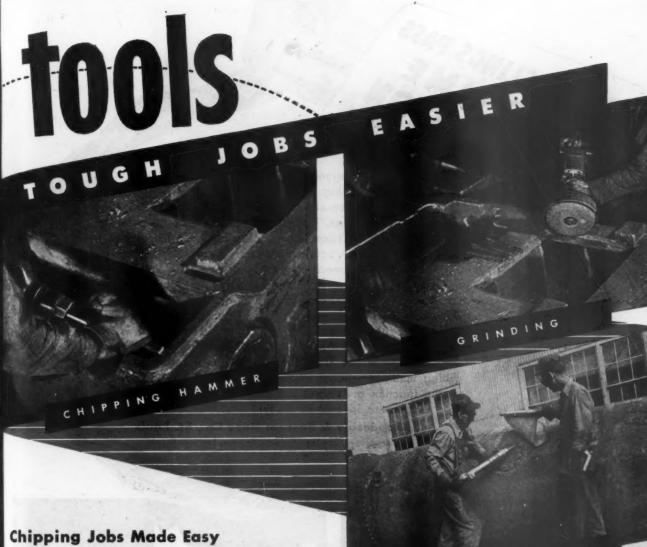


Grip Threttle—The grip throttle is the most desirable type for grinders of 6" wheel capacity and larger. It is adapted for overhead operation, for working in close and awkward places, and for work where a straight forward thrust of the machine is desired. On the grip handle, the throttle is self-closing



primary feature of the level throttle. The instant the level is released the power is at offi. This automatic action is helpful in hazardous work or construction and maintenance, and reduces accidents due to carelessness.

Model 360G



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Everything you want in speed and power for fast removal of metal you'll find in Thor Chipping Hammers .. plus the ability to take a wide range of cuts with the same tool. With Thor's perfect throttle control the hammer can be started slowly with a light blow, then gradually and smoothly stepped up to a maximum speed and power. You get smooth, even chips with less effort by the operator. Positive cylinder valve action, with the air for the power stroke and the air for the return stroke supplied through different ports, assures the ideal combination of speed, power and smoothness. Perfect balance between this speed and power and the weight distribution reduces vibration to a minimum.

### **Fast Rivet Busting**

Thor Rivet Buster construction is the achievement of long years of engineering experience in the building of pneumatic tools for jobs that require speed, power and accuracy. Thor Rivet Busters have all the improvements in design and construction which are so essential to tools that must stand up under the shock and strain to which they are subjected to in today's fast moving industrial jobs.



INEER

THESE SLINGS PASS FOR SAFETY ... SPEED ... ECONOMY OF MANPOWER AND MATERIALS

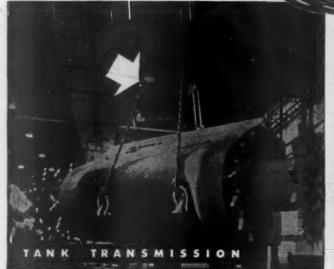
When virtually every load is tagged for war production, efficient handling becomes an obligation—one you'll discharge on all counts with Yellow Strand Braided Wire Rope Slings.\* Safety? The strength of this patented

sling lies in tough Yellow Strand Wire Rope, so braided that it gains marked flexibility . . . conforms readily to any product . . . grips it gently but securely. Speed? Light weight and high kink-resistance make the sling easy to carry, attach and remove. Economy? A compact braided sling conserves manpower and materials, compared with bulky types. Even when lifting heavy locomotives, turbines, pressure towers or weapons, a Yellow Strand Braided Sling will require fewer men -and less steel. And for such lighter lifts as jigs, tools, drums or crates, a Yellow Strand Sling offers relief from the fiber shortage. Fitting material-handling equipment to your specific job is the function of Broderick & Bascom's specialized Sling

> Engineers. Investigate today! Broderick & Bascom Rope Co., St. Louis Branches: New York, Chicago, Houston, Portland, Seattle Factories: St. Louis, Seattle, Peoria

FREE Riggers' Hand Book

96-pages of practical wire rope sling information. Send for free copy.







\*Patents: U. S., 1475859, 1524671, 2142641, 2142642, 2299568. \* Canadian, 252874, 258068

YELLOW STRAND

Braided Wire Rope SAFETY SLINGS



Red Lead's outstanding uniformity of performance results not only from its extreme purity but also from its precise chemical composition...lead orthoplumbate. This makes for predictable chemical behavior.

For many years Red Lead has been the standard among metal protective paints because of inherent fundamental properties of the pigment itself.

Among the most important of these is Red Lead's definite chemical composition and uniformity—as distinguished from pigments which have indefinite composition or vary from batch to batch, with resulting possibility of variation in performance.

One reason for this uniformity is that Red Lead is a simple chemical compound, being made from oxygen and high purity metallic lead. Consequently, Red Lead is an extremely pure compound. It contains no corrosion accelerating impurities such as water-soluble salts of chlorides or sulfates.

Uniform composition means dependable performance, day after day, job after job.

Furthermore, Red Lead has the property of counteracting acid conditions, recognized as accelerators of rust. In the presence of various acids, Red Lead forms

insoluble neutral lead salts at the approximate rate at which the acids are supplied. This is true whether the acids originate from acid forming environments, such as gas, smoke and moisture in the atmosphere, or from the decomposition of the vehicle. Thus, a rust inhibiting condition is maintained with a Red Lead paint.

Remember, too, that Red Lead is compatible with practically all vehicles commonly used in metal protective paints, including phenolic and alkyd resin types.

### Specify RED LEAD for <u>All Metal Protective Paints</u>

The value of Red Lead as a rust preventive is most fully realized in a paint where it is the only pigment used. However, its rust-resistant properties are so pronounced that it also improves any multiple pigment paint. No matter what price you pay, you'll get a better paint for surface protection of metal, if it contains Red Lead.

### Write for New Booklet

"Red Lead in Corrosion Resistant Paints" is an up-to-date, authoritative guide for those responsible for specifying and formulating paint for structural iron and steel. It describes in detail the scientific reasons why Red Lead gives superior protection. It also includes typical specification formulas. If you haven't received your copy, address nearest branch listed below.

The benefit of our extensive experience with metal protective paints for both underwater and atmospheric use is available through our technical staff.



NATIONAL LEAD COMPANY: New York 6, Buffalo 3, Chicago 80, Cincinnati 3, Cleveland 13, 8t. Louis 1, San Francisco 10, Boston 6 (National-Boston Lead Co.; Pittsburgh 30 (National Lead & Oil Co. of Penna.); Philadelphia 7 (John T. Lewis & Bros. Co.)

RED LEAD

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HOW LONG TO FACE THIS ROUGH



### A FEW OF THE RAILROAD JOBS YOU CAN DO FASTER AND BETTER WITH A DIAMOND FACE GRINDER:

Guides
Chafing Plates
Lateral Clevis
Blocks
Wedges
Reverse Links
Engine Truck
Pedestals
Spring Saddles
Valve Cross Heads
Plates and Guides
Air Pump
Cylinders
Steam Pipe Joints

Addre

Flat Spring
Hangers
Shear Knives
Engine Truck and
Trailer Boxes
Engine Truck
Cellars
Spring Equalizers
Link Blocks
Locomotive
Pedestal Caps
Fedestal Cap
Filler Blocks

Eccentric Cranks

Railroad shop men call it a guide bar. But by any name this rough forging, measuring 4-15/32" x 3-15/16" x 61½" long, would take plenty of minutes for facing 4 sides with cutting tools.

With a Diamond Face Grinder the job is a cinch. You simply set it up against a magnetic chuck and in approximately 100 minutes floor-to-floor you're finished—sizing to 4" x 3½" on the nose.

Face grinding produces the first flat surface regardless of surface conditions, saves time and material. Face grinding with the heavier, huskier Diamond Face Grinder is easy to learn.

"THE DIAMOND



THAT CUTS YOUR COSTS"

MAIL TODAY FOR NEW FOLDER

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MACHINE COMPANY
OF PHILADELPHIA

The second of the Continue Company, builder of the machinery for ever 71 years and

## Easily handled BY ONE MAN



Lightweight inspection cars, which can be handled easily by one man, again are being made of Alcoa Aluminum by Fairmont Railway Motors, Inc., Fairmont, Minn.

Not only are the new models now available but aluminum replacement parts for wartime models can be obtained for cars now in service. Weight reductions of as much as 100 pounds are possible by modernizing with interchangeable aluminum parts.

Fairmont engineers point out that the aluminum construction gives more power per pound of weight, provides greater safety and durability.

ALUMINUM COMPANY OF AMERICA, 1929 Gulf Building, Pittsburgh 19, Pennsylvania.



Heavy wartime models can be modernized with interchangeable aluminum parts.

ALCOA ALUMINUM



What's time to a hog?

They tell of a mountaineer who stood holding up a shoat while it ate persimmons from a tree.

A stranger came along. "You may get that bog fat after a while," be remarked, "but it'll take a long time."

"Hub," was the reply, "what's time to a hog?"\*

IT'S a far cry from that scene of leisure to the railroad yard, where time is all-important—where cars must be put in shape to go out on the road again at once.

That's where Wyandotte Railway Cleaning Products do a star performance. Specialized to meet cleaning needs, they waste no time in removing grit and soot, grease and carbon, oil and dirt deposits.

The Wyandotte Representative has a full line of maintenance and backshop cleaners. Ask him to show you how they will go to work for you without upsetting any cleaning or washing program.

\*From B. A. Botkin's,
"A Treasury of American Folklore"

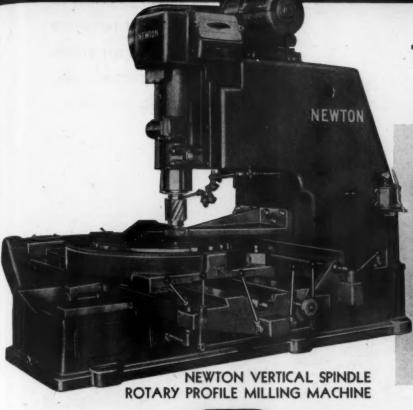


### WYANDOTTE CHEMICALS CORPORATION J. B. Ford Division

WYANDOTTE, MICHIGAN, SERVICE REPRESENTATIVES IN 88 CITIES



### TRAINS OF TODAY RUN ON THEIR MAINTENANCE-MEN AND TOOLS



the tools that help to keep them rolling

The Newton Vertical Spindle Rotary Profile Milling Machine is designed to meet motion-shop profiling requirements. Built in two sizes, one with 32" diameter table and a larger size with 41" diameter table.

The Betts-Bridgeford Three-Carriage Journal Truing Lathe refinishes and burnishes worn journals on car wheel sets without removing the wheels. The third carriage turns and burnishes inside journals. With blocks in place, it serves as an Axle Lathe.



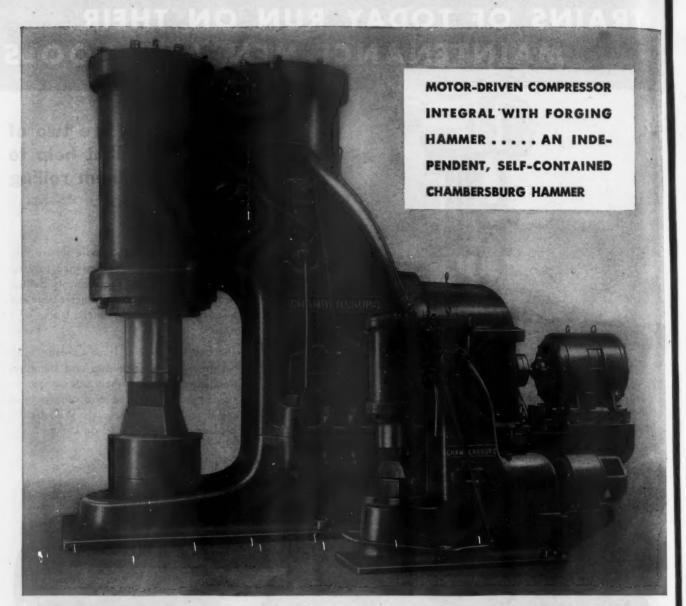
ASK THE MAN IN THE RAILROAD SHOP . . . .
HE KNOWS CONSOLIDATED RAILROAD TOOLS

BETTS . BETTS - BRIDGEFORD . NEWTON . COLBURN . HILLES & JONES . MODERN



CONSOLIDATED MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK





### A GREAT RAILROAD TOOL

DELIVERING a greater forging output than any other hammer of its type, the Chambersburg Pneumatic Forging Hammer is an ideal tool for railroad shops. The hammer can be located where most convenient, it starts instantly and strikes a constant number of blows heavy or light at the will of the operator. As soon as the motor is up to speed the hammer is ready to operate.

A new bulletin No. 1275 is now ready.

Write for your copy.



CHAMBERSBURG ENGINEERING CO., CHAMBERSBURG, PA.



CHAMBERSBURG

HAMMERS · CECOSTAMPS · PRESSES

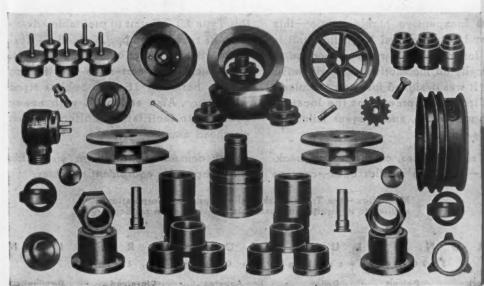
# Save Time Cut Costs ON YOUR TURRET LATHE JOBS!

WARNER & SWASEY Turret Lathes in railroad shops are adaptable to hundreds of jobs ranging from small brass lubricator parts to heavy-duty work on Crankpins and Cylinder Bull Rings. Whether the run is one

piece or a thousand, you will find Warner & Swaseys low cost producers.

In producing the accurate parts illustrated below, much of the versatility of the turret lathe was brought into play to handle forming cuts, drilling, boring, reaming, and end facing. Using a universal standard tooling setup, much valuable setup time is saved when switching from one job to any of the hundreds of other railroad jobs that can be handled on a Warner & Swasey. If you want to save time and cut costs on your turret lathe jobs—put them on the Warner & Swasey.

Typical examples of railroad jobs produced on Warner & Swasey Turret Lathes.





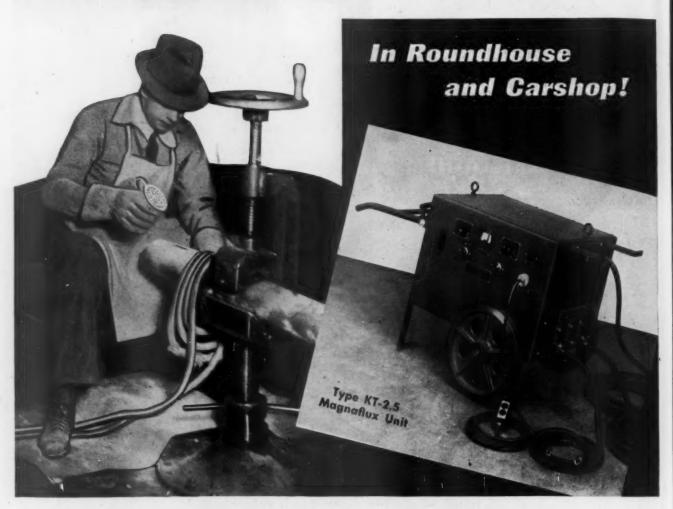
A Warner & Swasey 4-A turns and threads a Crank Pin job in a southern railroad shop. With one roughing and one finishing cut the 3½" diameter har stock is reduced to 3½" for rod collar nut fit. A moment's change-over makes the same machine ready for a Valve Follower Head job.

### PRODUCTIVE TOOLS MAKE PRODUCTIVE TURRET LATHES

This Warner & Swasey Tool Catalog shows how to make turret lathes produce more profitably. It shows a complete line of 596 turret lathe tools tagether with data on spindle noses, cross slides, and turret faces for all Warner & Swasey Turret Lathes. Write for a free copy.



### LOW-COST OVERHAUL INSPECTION



A New, Rugged "Push-Cart Style"

### MAGNAFLUX\* UNIT

(Price Complete, \$455.00, F.O.B. Chicago)

● Inexpensive, highly mobile—this new and very practical Magnaflux unit is ideal for magnetic particle inspection of practically all locomotive, car and similar parts. It was designed for use particularly on railroad equipment, for the location of fatigue cracks, and prevent failure in service.

All roundhouses, carshops and backshops—even the smaller ones—can use this Type KT-2.5 unit to profitable advantage. Its rugged, compact, welded all-steel frame will stand a lot of shop punishment. Convenient push-cart style with folding handle bars and 16-inch rubber tired wheels . . . Also equipped with heavy eyebolts to facilitate handling with an overhead crane.

Safety demads the thorough inspection that Magnaflux equipment provides.



\*Magnaflux—the Trade Mark of the Magnaflux Corporation applied to its equipment, materials and inspection methods.

MAGNAFLUX CORPORATION

New York

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Our research work has always been strongly identified with cutting materials. With the various high-tungsten types of High Speed Steels as the starting point, followed by the development of the "moly" types, Allegheny Ludlum technicians later originated the patented DBL low-tungsten analysis of High Speed Steel, which has played a major role in wartime tungsten conservation.

Years earlier, our Laboratories did much basic development work on carbides, when they were first introduced in this country. At that time, we registered the trademark "Carmet." Now, with the re-establishment of our Carbide Manufacturing Division, an advanced and complete line of Carmet carbidetipped tools and carbide metal blanks is available, thoroughly researched and effectively enhancing

Allegheny Ludlum's service to users of cutting materials. We invite your attention and inquiries.



WAD 9490

## GAP LATHES

FOR PISTONS AND MANY OTHER JOBS



E VERY railroad shop and engine-terminal handling classified repairs is a logical point for the installation of an L & S Gap Lathe.

Take for example your piston rod truing jobs—You do not have to remove the heads when you have an L & S Gap Lathe—All you have to do is to remove the Gap Lathe block.

There are lots of other jobs which, even though large in diameter, do not require the use of a

heavy lathe. When such work is performed on an L & S Gap Lathe, a decided saving is made, not only on initial costs but also on operating and maintenance costs.

Lodge & Shipley Gap Lathes are obtainable in sizes from 12" to 27". A wide range of Engine Lathes, Tool Room Lathes, Manufacturing Lathes and Large Hole through Spindle Lathes with various attachments are available to suit your specific requirements.

AUTOMATIC TOOL ROOM OIL COUNTRY LATHE

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ACHINE TOOL CO

CINCINNATI, 25, OHIO, U.S.A.

Lathed

I make little jobs out of big ones!

> The BUDA Two Speed Hydraulic Jack pictured for car repair work is just one of dozens of BUDA Hydraulic and Mechanical Railto do jobs faster, safer and at lower cost. Write for descriptive bulletins.

I'm the in every sturdy UDA railroad jack

THE BUDA COMPANY

15407 Commercial Ave., Harvey (Chicago ) Illinois



SIMPLIFIED! No complicated features! No "unwanted equipment." You get the Oster No. 601 "RAPIDUCTION" with just the features YOU specify... either with the self-indexing six-position turret or with a plain saddle and single tool post... either with the WORM DRIVE (for smooth, ample power to make unusually heavy forming cuts) or with the DIRECT DRIVE (for high spindle speeds up to 3000 R. P. M. required for small diameter work or on non-ferrous metals).

Those, and other features, actually give you a "standard-special" machine but with no special costs. Write for full description. Ask for Catalog 27-B.



### "Riduction" LATHES

THE OSTER MANUFACTURING COMPANY, 2074 EAST 61st ST., CLEVELAND 3, OHIO, U. S. A.

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ELECTRICAL SPECIALTY COMPANY, 316 Eleventh Street, San Francisco 3, California INSULATION & WIRES, INC., 2127 Pine Street, St. Louis 3, Missouri INSULATION MANUFACTURERS CORPORATION, 565 Washington Blvd., Chicago 6, Illinois MICA INSULATOR COMPANY, 200 Varick Street, New York 14, New York NATIONAL ELECTRIC COIL COMPANY, Columbus 16, Ohio PREHLER ELECTRICAL INSULATION CO., 564 West Monroe Street, Chicago 6, Illinois WESTINGHOUSE ELECTRIC & MANUFACTURING CO., Trafford, Pa.

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### **Essential to High Temperature Silicone Insulation**

Rapidly growing demands for IC-993 Silicone Varnish are being filled from stocks of the above newly-appointed distributors.

Through these representative sources of supply, Dow Corning, first producer of Silicones, is able to extend the application of this revolutionary insulating material—a heat curing, high temperature stable, moisture-proof silicone varnish destined for an important place in the new age of electrical machinery and equipment.

DOW CORNING CORPORATION BOX 592. MIDLAND, MICHIGAN JUST OFF THE PRESS—This new eightpage book on IC-993 Silicone Varnish is now available from any of the distributors listed above. Write for a copy. It will give you comprehensive technical information on this new insul

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technical information on this new insulating material and its applications.





metallurgical research has gone into perfecting a line of electrodes which

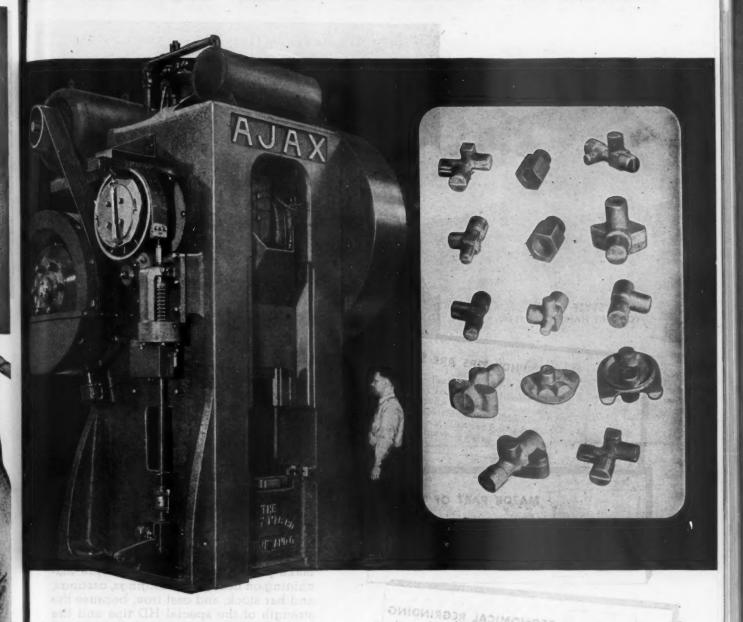
result is a winner-a true champion both in name and performance.



THE CHAMPION RIVET CO.

11600 HARVARD AVE. . CLEVELAND, OHIO EAST CHICAGO, IND.

## A BETTER WAY IS HERE TO STAY



★ In the world of tomorrow hundreds of materials, processes and production methods developed and proven so advantageous to to meet the gargantuan demands of this war, will be used extensively and most profitably in an era of peace.

Among those production methods which have been greatly used and thoroughly proven is the Press Forging at high rates of production, of ferrous and non-ferrous

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hydrautic fittings where castings would formerly serve. The factors of greater production speed, superior reliability, increased strength, less waste of material cleaner surfaces, more accurate dimensions and better utilization of man power which

> called for press forging of fittings for war, will be the production advantages so vital in the competitive peacetime economy to come.

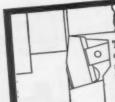
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EUCLID BRANCH P. O., CLEVELAND 17, OHIO



STYLE 12 HD (OPPOSITE HAND-STYLE 11 HD)



## "HD" TIPS ARE STRONG

Tip is firmly supported—underside is diamond ground, and rests on plane surface of recess which is finished true with Kennametal Milling Cutter or End File. Thermally strain-free assembly also helps prevent tip breakage.



501 AFTER MANY REGRINDS

#### MAJOR PART OF TIP USED

When dull, tip can be advanced, and resharpened time and again, until the major part of it has been used.

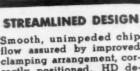


## ECONOMICAL REGRINDING

Only the tip is regroundno shank steel is removed. Operation is fast—clogging of diamond wheel grinder with steel is prevented.



Smooth, unimpeded chip flow assured by improved clamping arrangement, cor-rectly positioned. HD design employs pressures set up in cutting as factors to help hold tip in place.



## for HEAVY-DUTY Machining on Steel and Cast Iron

Kennametal HD Clamped-On Tools make practicable high rate carbide machining on heavy steel forgings, castings, and bar stock, and cast iron, because the strength of the special HD tips and the perfected design of the tool enable deep cuts and heavy feeds to be taken at intermediate speeds, with amazing tool life.

HD Tools are now available in two styles -11HD and 12HD-for heavy duty turning and boring operations, with special HD tips in Grade KM for general steel cutting, Grade K2S for machining very rough or scaly steel castings, and Grade K6 for cutting cast iron. Larger sizes, i.e., with shanks 1" to 2" wide, are now being produced.

Catalog information, and prices, will be sent immediately upon request.



## FEWER TOOLS REQUIRED

Many tips can be used during the life of a shank, and tip of suitable Kennametal composition can be used for each job.

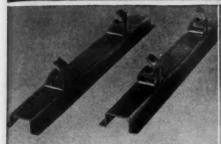


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Try

# WELDING DISTORTION STRESSES AND OVERHEATING



Arc welding bombsight hanger on frame member of plane produced severe warping and misalignment. Eutectic Low Temperature Welding prevented distortion and formed strong joints.



Cast iron motor heads are safely repaired without danger of subjecting to stresses, eliminating need for costly and lengthy after machining always necessary to correct distortions.



Worn motor armature shaft resurfaced by Eutectic Low Temperature Welding completely avoiding warping of shaft and preventing destruction of windings by excessive heat.

# WITH EUTECTIC

Low Temperature

## WELDING RODS

Bond metals at temperatures as low as 340° F. Reduce heat consumption . . . cut welding costs

Now, without resorting to high temperatures, you can gain the advantage of the strong bonds formed by fusion welding.

The most revolutionary welding development of modern times—EUTECTIC

Low Temperature Welding enables you to join metals at temperatures below the fusion points of base metals.

Eutectic welding rods and fluxes are available for joining all metals by means of gas—arc—induction—furnace and all standard methods of heating.

Try Eutectic for Production—Salvage and Maintenance welding.



Castolin Extection

#### EUTECTIC WELDING ALLOYS COMPANY • 40 WORTH STREET, NEW YORK 13, N.Y.

Send me full information for purchasing introductory assortment of important Eutecrods for Production Salvage and Maintenance welding. Please send me The Eutectic Catalog 'ft containing complete information about Eutectic Low Temperature Welding and its 6 great advantages.

Name\_

\_Position.

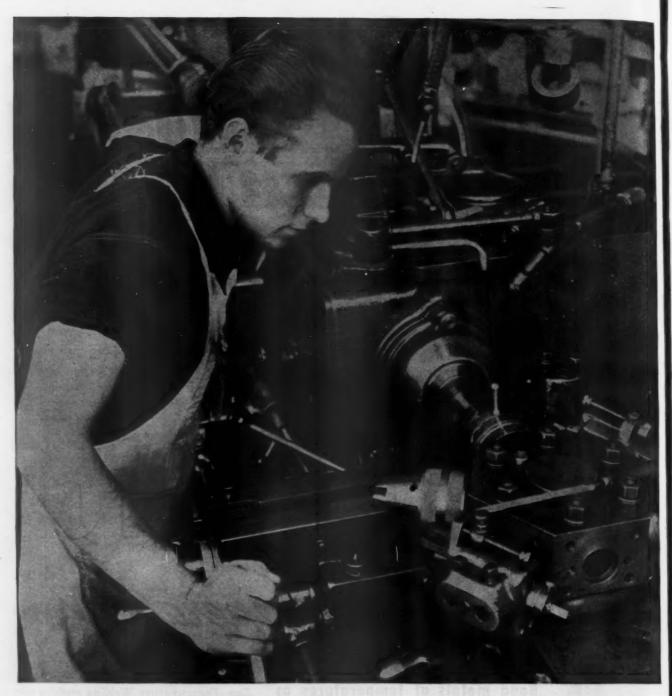
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**EUTECTIC** way.

Try it today!



# LANDMATIC Hardened and Ground or Heat Treated DIE HEADS

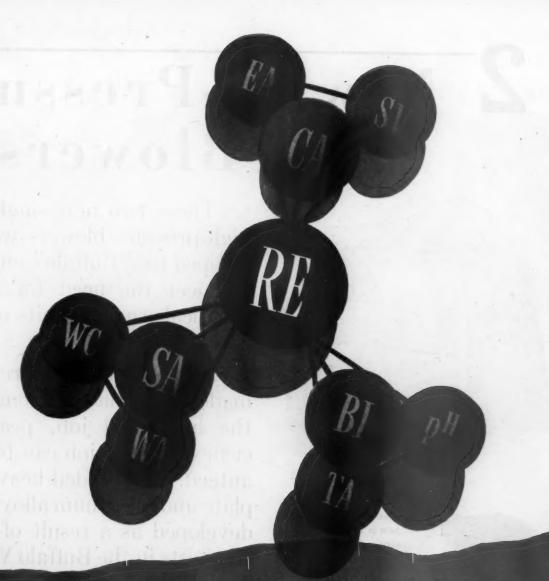
Are Used in Turret Lathe Operations in Most Aircraft Plants

The few operating parts of LANDIS Die Heads and their precise assembly make it possible to produce threads within extremely close tolerances on a high production basis.

Send for Bulletins describing Landmatic Die Heads

# LANDIS MACHINE COMPANY, WAYNESBORO, U.S.A.

THREAD CUTTING MACHINES . DIE HEADS . COLLAPSIBLE TAPS . THREAD GRINDERS



## THIS IS WHAT HAPPENS WHEN YOU WASH A LOCOMOTIVE

Correctly cleaning a locomotive is no simple operation...these elements must go into action...

Wetting Action (WA) must lower surface and interfacial tensions and allow the cleaning solution to penetrate to surface of the base. Emulsifying Action (EA) must disperse grease and oil as tiny globules, and by suspension prevent redeposition. Saponifying Value (SV) must convert organic fats and oils into soluble soaps, and Solvent Action (SA) put soils into solution. Colloidal Activity (CA) must disperse solid soils into minute particles which may then be easily removed. Water Conditioning (WCf removes or controls the elements which cause water hardness.

Correct Buffer Index (81) assures ability to absorb either alkaline or acid soil, thus prolonging efficiency of the solution. Proper phil assures the correct measure of energy of alkalinity and Total Alkalinity (TA) must supply maximum active cleaning energy:

In formulating a cleaning compound, therefore, it is abvious that no one factor is a magic key to all problems. The answer is in determining the relative value of all these factors as they apply to your problem.

Putting these factors into correct balance is a responsibility you can entrust to Turco chemists—a responsibility for which their two decades of Research and Experience (RE) have well qualified them. Take your problem to Turco

For a fuller explenation of these vital factors, write for Turce's Booklet on your first letterheed, please

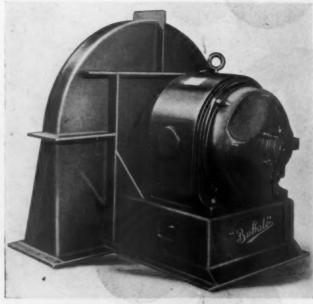


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# 2 New Hi-Pressure Blowers—





Above—Buffalo Type "CC" Centrifugal Compressor, built in a wide range of capacities for pressures up to 4 lts.

Left—Buffalo Type "CB" Centrifugal Blower for pressures up to 2 lbs.

There is now a new bulletin No. 3553 at the printers. This gives construction details and other data on centrifugal and compressors. Write for it.

These two new single stage high-pressure blowers were developed by "Buffalo" engineers to meet the need for simple, practical, rugged units of moderate cost.

Since these units are tailormade to fit the requirements of the individual job, peak efficiency on each job can be guaranteed. All-welded heavy steel plate and aluminum alloy rotors, developed as a result of extensive tests in the Buffalo Vacuum Test Pit, are used.

From operating costs already established, it is clear that Buffalo Hi-Pressure Centrifugal Blowers and Compressor will cut air costs on many jobs.

## **Buffalo Forge Company**

174 Mortimer Street Buffalo, N. Y. Canadian Blower & Forge Co., Ltd., Kitchener, Ont.



Centrifugal
Blowers and
Compressors



### CUT OPERATING COSTS

• Forged from carbon steel specially-processed to exacting specifications, Williams' "Superior" Wrenches average 93% as strong as corresponding alloy wrenches costing almost twice as much. Their strength is almost double that of old-fashioned carbon steel wrenches. "Superior" Wrenches are available in a wide range

of patterns and sizes.
Sold by leading Industrial
Distributors everywhere.

J. H. WILLIAMS & CO., Buffalo 7, New York.



# What's Your Piping Materials Problem? ... CRANE Has the Answers!

ONE SOURCE OF SUPPLY
ONE RESPONSIBILITY FOR ALL PARTS
ONE STANDARD OF QUALITY

No matter what your need in piping materials... your Crane Branch or Wholesaler can meet it. One order covers all requirements at any time. You choose from the world's greatest line of piping materials—in brass, iron and steel. You help assure the best piping installation because all parts are of uniformly high quality—backed by a single responsibility. Not only do you simplify and speed deferred replacement work by using Crane complete piping materials service—but you get full benefit of Crane Co.'s 90-year experience in the piping equipment field.



SERVICE RECOMMENDATIONS: Crone Standard Iron Body Wedge Gate Valves with brass trim are recommended for steam, water or oil lines; all-iron valves for oil, gas or fluids that corrode brass but not iron. Made in O.S. & Y. and Non-Rising Stem patterns.

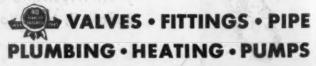
idaged cooks	Screwed or Flanged Valves		<b>Hub End Valves</b>
Size of Valve	Saturated Steam	Cold Water, Oil, or Gas, Non-Shock	Cold Water or Gas Non-Shock
2 to 12 in. 14 and 16 in.	125 pounds 125 pounds	200 pounds 150 pounds	200 pounds 150 pounds
18 to 24 in.	wash & sail	150 pounds	150 pounds

<sup>\*</sup> For steam lines larger than 16-inch, Crane 150-pound Cast Steel Gate Valves are recommended.

CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill. • Branches and Wholesalers Serving All Industrial Areas







# BULLARD lut Master







For Precision and Economical Production

O PLAN for the modernization of a locomotive shop can be complete without a thorough investigation of the economies offered by the BULLARD Cut Master type Vertical Turret Lathes.

Special features which assure extreme accuracy and big savings in production costs include: tremendous power, wide selection of speeds and feeds, electric interlocking and limit switches, foolproof control and three cutting heads if needed.

Keep in mind the fact that BULLARD engineers are working on some phenomenal improvements for railroad shop boring and turning mills. Complete details to be released in the near future.



THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT



## IN RAILROAD TOOL ROOMS, TOO

#### Gisholt Turret Lathes Pay Out

In meeting wartime emergencies, railroad shops all over the country have proved the value of Gisholt Turret Lathes—building stocks of standard replacement parts—saving time and money to keep the rolling stock rolling.

But here's another example—in the tool room of a locomotive boiler shop. Here Gisholt Turret Lathes are used to manufacture a variety of boilermaker tools and flue cleaner parts. Producing them even in such small quantities as 12 per lot, this Gisholt 1 L High-Production Turret Lathe proved itself both practical and profitable—doing more work than two other type lathes, and at lower cost.

Gisholt engineers, familiar with railroad shop work, will gladly discuss your particular problems with you.



GISHOLT MACHINE COMPANY
1293 East Washington Avenue • Madison 3, Wisconsin

Look Ahead... Keep Ahead... With Gisholt Improvements in Metal Turning



JETIT!

## ADJUSTABLE TOOL HOLDER

with all these features:

- 1. Exclusive vise-grip jaw exerts 4-sided pressure evenly over full length of cutter channel, prevents sagging under-channels and broken bits.
- Bearing surface of the adjustable vise-grip jaw has twice the width and five times the length of the average tool holder, and takes 4 or more sizes of tool bits.
- Vise-grip jaw clamps large heavy bits or short stub ends with the same rigidity as forged tools.
- Dual and narrow tool bits are firmly held for cutting-off or special forming operations.
- Vise-grip securely holds and supports carbide bits, threading tools and boring bars. Protruding underlip prevents breakage.
- Tilted position of head gives operator unobstructed view of cutting edge.

#### SPECIFICATIONS

MODEL	SIZE	CAPACITY		
60	0	1/8 to 5/16		
61	1	3/16 to 3/8		
62	2	1/4 to 1/2		
64	4	5/16 to 5/8		

With 15° or parallel cutter channel either left or right hand.

For complete information, call your Clark Cutter Jobber today, or write for catalog RME-3-TH.

> **Tool Holder P62R gripping** Clark Lever-Lock Boring Bar





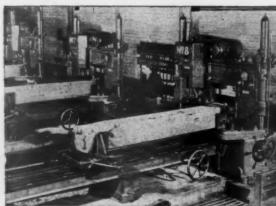




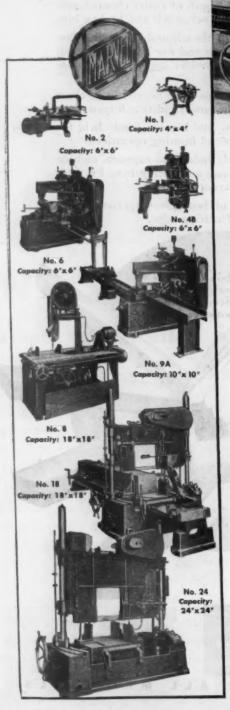


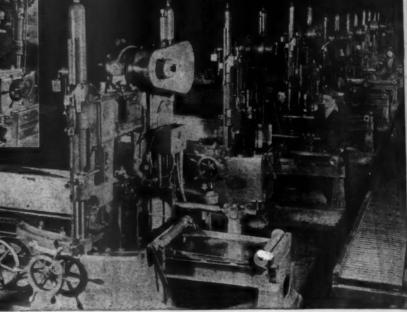


CUTTING TOOLS FOR STABLE



Part of the row of No. 18 MARVEL Giant Hydraulic Hack Saws used to crop and out-off test slices for metallurgical tests for large billets of tough alloy steels.





## MARVEL No. 18 Hydraulics 12 in a row!

When a greatly expanded steel plant, near Canton, Ohio, faced the problem of cropping and cutting-off test samples from large alloy billets, in *wartime* quantities and at wartime speed, they checked the performance of all types of cutting-off equipment in all their other company plants, and selected MARVEL No. 18 Giant Hydraulic Hack Saws for this "tough" job.

Now this row of twelve MARVEL No. 18 Hydraulics shown above, operating continuously, 24 hours a day on tough alloy billets of from 14" to 16" cross section, handle this tremendous, heavy duty cutting-off job without a hitch and with a minimum of man hours—only four operators per shift.

When you have a cutting-off problem your most logical first step is to check with your local MARVEL Sawing Engineer for recommendations of methods and equipment.

### ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 W. Bloomingdale Ave. Chicago 39, U. S. A. Eastern Sales Office: 225 Lafayette St., N. Y. 12, N. Y.



STANDARD CARBOLOY . TURNING . FACING . BORING TOOLS

FOR GENERAL USE

POINTED NOSE

FOR REAMERS



BUSHINGS FOR GAGES AND GENERAL USE

GENERAL USE

GROOVING TOOLS

BORING TOOLS

WEAR-RESISTAN

LER TURNER TOOLS

MANY CARBOLOY STANDARDS NOW COST LESS THAN ORDINARY TOOLS



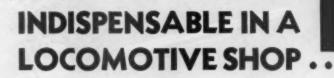
CARBOLOY COMPANY, INC. . 11177 E. 8 MILE ROAD . DETROIT 32, MICHIGAN CHICAGO . CLEVELAND . HOUSTON . LOS ANGELES . MILWAUKEE . NEWARK . PHILADELPHIA . PITTSBURGH . THOMASTON

ALSO SOLD BY LEADING MILL SUPPLY DISTRIBUTORS

RAILWAY MECHALITALE

LUCAS "PRECISION" SCOPE OF APPLICATION





DUE to its design, it is obvious that the LUCAS Horizontal Boring, Drilling and Milling machine is a general purpose tool. Its cost-saving scope of application covers so many jobs that many railroad shop foremen claim it is indispensable.

The biggest savings effected are on large and cumbersome parts that require several operations which are difficult to handle on any other unit, but simple to set up and machine on a Lucas. These parts include stokers, feedwater heaters, power reverse gears, coal pushers, dry pipes, one-piece truck frames and many other components.

Upper illustration shows a LUCAS boring a stoker engine cylinder—the cylinders did not have to be removed from the bed. Bottom view shows a recent installation drilling holes in a heavy Mallet type bumper and supporting bracket. Yes! You can always keep a LUCAS saving money in your shop.

LUCAS MACHINE TOOL CO.

# 7 REASONS\* WHY

# Your best bet for AC Welding is a "Bumblebee"

Every feature of design and construction, both inside and outside the sturdy case of the Wilson "Bumblebee", has been planned to give the utmost in efficient, dependable and economical service:

- Precise, Stepless Adjustment of Welding Current to any value within NEMA range, provided by easy-turning crank.
- Efficient Ventilation by motor-driven fan assures safe, dependable operation, even when welding with maximum current.
- Reduced Power Factor Charges and relief for overloaded power lines is provided by built-in capacitors.
- Coils Protected Against Fire and Vermin by mica and glass fabric insulation.
- Interchangeable Primary Terminals permit easy, rapid change from low to high line voltage or vice versa.
- Output or Secondary Terminals Readily Accessible by removing 4 screws which hold small insulating panel.
- High Visibility of Current Indicator is assured by large, easily read calibrated scale located outside case.

These features are incorporated in every "Bumblebee" welder—either regular or all-weather model. "Bumblebee" welders are also performing a valuable service as a power source for automatic welding heads.

In addition, the "Bumblebee" offers all the advantages of AC welding:

- -Low Maintenance because of absence of moving parts
- -Low Power Costs because of high electrical efficiency
- -Faster Welding due to absence of arc blow and use of larger electrodes
- -Improved Quality of Welds

-at no greater first cost than other types of welding equipment.

Other AC welders in 100, 200, 750, 1000 ampere sizes.

Mail the coupon today for new catalog – or write to

your nearest Airco office.

BUY UNITED STATES WAR BONDS



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General Offices: 60 East 42nd Street, New York 17, M. Y. In Texas: Magnolia Airce Gas Products Co. General Offices: Houston 1, Tax. Offices in all Principal Cities

300 AND 500 AMPERE SIZES PME Air 60 E. 42nd Street New York 17, N.Y. Please send copy of your ew "Bumblebee" Catalog Address . .

with a Stinger that Penetrates



Now you can have a better welding electrode... one that lasts longer and is easier to apply... for building up switch points, frogs, crossings and similar high carbon and/or high manganese steels!

McKAY FROGALLOY is specially made for the job. The weld metal will not cross check or crack under the deposit. Although soft in the "as welded" state, it work hardens rapidly . . . permitting heavy pads to be built up without danger of mushing down, cracking loose, spalling or flaking when subjected to constant

wear and service. Exceptionally smooth flowing properties make it unusually easy to apply. It does not require pre-heating or frequent delay for peening.

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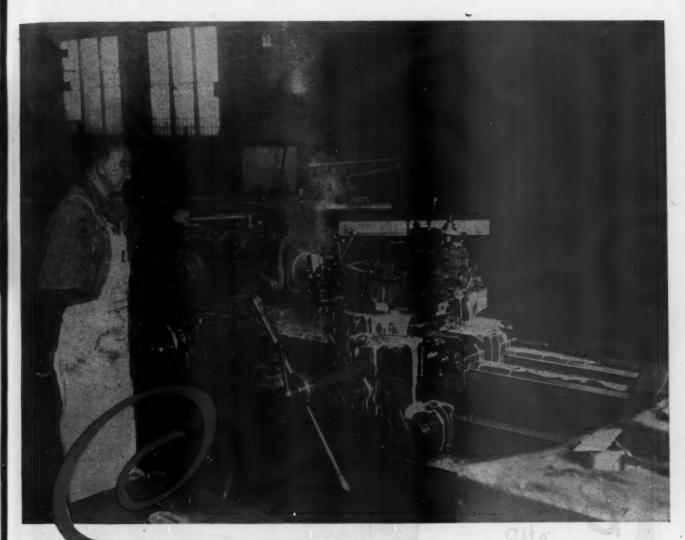
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# Conomy starts with modernization

To Modernize, with Jones & Lamson Universal Turret Lathes, is to Economize.

All the essentials for fast, economical turret lathe production are built into these machines. Rigidity, Speed, Power and Ease of Operation are combined in them to take full advantage of modern fast-cutting tools with minimum fatigue to the operator.

A complete line of Universal Turret Lathes, with from 1½ inches to 8 inches bar capacity, is available for railroad maintenance and shop requirements.

Our book, Turret Lathe Earning Power, will tell you more about the productive advantages of these machines, and will be sent to you upon request.





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MACHINE COMPANY Springfield, Vermont, U.S.A. Monufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.



ON 7'HYPRO **BORING MILL** 

-an additional feature illustrated above-Ease of Operation,

The casting shown is a cast steel shovel base of 163-212 brinnel hardness. Eighteen operations are performed on this casting at one setup, at speeds from 2.4 to 33 R. P. M. and feeds from .015 to .042 per revolution. The entire operation, in addition to setup and tool changes, is performed in 8 hours, 15 minutes at the Lima Locomotive Works Shovel and Crane Division.

Write for Bulletin 132R describing this versatile mill.

## THE CINCINNATI PLANER COMPANY

Planers... Vertical Boring Mills... Planer Type Millers OHIO . U.S.A. CINCINNATI .

# Snap.on Wrenches

#### For Efficient Maintenance

Time and manpower saved on every maintenance operation counts today as never before! For hundreds of routine maintenance jobs such as this, modern Snap-on wrench equipment provides speed, flexibility and accessibility, with safe, powerful leverage to turn the biggest, tightest nuts.

In Snap-on's heavy duty Loxocket wrenches the automatic locking device makes any combination of handles and sockets safe as a onepiece wrench... and the fast thumb button release permits immediate change of hookup to clear obstructions. The ratchet action operates within a 20-degree handle swing.

Standard Snap-on socket wrenches for industrial nut turning are available in complete series of handles and sockets in \(\frac{1}{4}\), \(\frac{1}{6}\), \(\frac{1}{2}\), \(\frac{1}{4}\), \(\frac{1}{6}\), \(\frac{1}{2}\), \(\fra

SNAP-ON TOOLS CORPORATION

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## PERFORMANCE REPORT --ON J-M INSULATIONS

PARSONS, KANSAS

WHEN APPLIED: 1923

MAINTENANCE:

Less than \$10 average yearly

PRESENT CONDITION: Excellent -- no loss in thermal efficiency

REMARKS: In the power plant of the M. K. & T. R.R. at
Parsons, Kansas, there are five Sterling 518 h.p. boilers, turning out approximately 30,600,000 lbs. of steam per month. The installation in 1923 included: 1780 lineal feet of J-M Asbesto-Sponge Felted in various thicknesses and diameters; 300 sq. ft. of J-M 85% Magnesia for covering feedwater heaters; and 3400 lbs. of J-M Asbestos Plastic Cement for pipe fittings and boilers. Considering the size of the installation, maintenance has been negligible -- approximately \$200 in 21 years, or less than \$10 average per year.



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Forgi



## 7 ADVANTAGES Forgings Offer

ligh tensile and impact strength obtained through concentration of grain structure and fibre-like flow lines.

Correctly proportioned combination of physical properties to meet a specific service condition.

Induction of dead weight; maximum strength and toughness in lighter sectional thicknesses.

4. Less time to machine and finish.

orgings facilitate rapid assembly through a welding adaptability of widest range.

Forgings reduce accidents to men and machines; provide a greater margin of safety.

Forgings can take it; maximum strength and toughts through a concentration of fibre-like flow line structure at points of greatest shock and stress.

• When you have to sell again to get an order you may find, as others have in the past, that selling against a product fortified with the qualities of forgings is both difficult and costly. Avoid the risk of a decline in preference for your product, which may occur and continue unnoticed, while another product establishes its ability to out-perform your product. Dependable performance is assured by the high tensile and impact strength, toughness and high fatigue resistance of forgings—qualities which are obtained by forging metal in closed impression dies, which process directions the fibre-like flow lines to meet specific service conditions.

Many manufacturers have found by rechecking highly stressed parts, as well as simple levers, against the seven advantages that forgings offer, opportunities to improve their product; to lessen weight; to reduce cost, to speed up assembly. A recheck of the parts you require may reveal unusual benefits which have been

overlooked or neglected. Consult a forging engineer connected with your source of supply. His broad experience will be helpful to you in obtaining all the advantages that forgings offer you.



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resistance welding

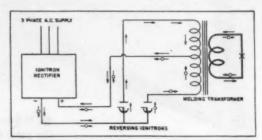
what it means

Spot, seam or flash welding steel in heavy gauges can now be accomplished on a balanced three phase load. This revolutionary achievement in power efficiency overcomes many limitations encountered with a.c. single phase welders. These are: disturbance to the usual three-phase supply by the unbalanced load, the heavy reactive load which results in low power factor, and the high power demand caused by secondary resistance. The Sciaky "THREE-PHASE" system reduces cost of power installation and cost of operation by providing:

- 1. A balanced three-phase load
- 2. Operation at near unity power factor (less KVA)
- 3. Decreased actual power demand (less KW)

how it op pates

As shown in the schematic diagram, all three phases of the a.c. line current are converted by an ignitron type rectifier to d.c. The welding transformer is of the standard single-



phase type, but has a center-tapped primary. The d.c. current is fed to the primary through a system of two ignitron tubes which fire alternately and allow the current to flow through only one winding at a time. Thus, while the direction of the current supplied by the rectifier is always the same, since it flows in only one winding at a time during successive impulses, it will flow in opposite directions in the primary. Therefore, the induced welding current in the secondary is a continuous alternating impulse of low frequency . . . of ideal wave shape and magnitude.

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Bulletin 204-A describing fully the operation of the Sciaky "THREE PHASE" will be gladly sent on request.

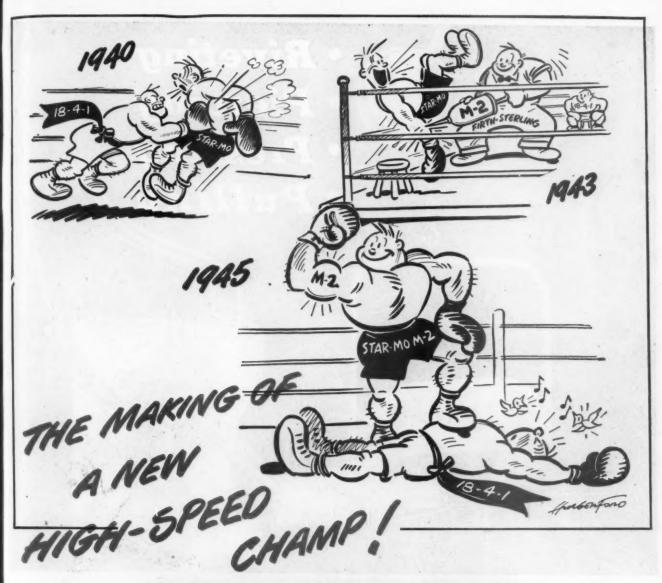
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TUNGSTEN-"MOLY" HIGH-SPEED STEEL

Ever since the new "M-2" analysis was adopted for tungstenmolybdenum high-speed steel, more and more manufacturers in the automotive and tool-making fields are recognizing with approval and satisfaction this new Firth-Sterling champion, STAR-MO M-2.

They have seen this new steel in action. They find it excels 18-4-1 in their plants. They are supporting it with enthusiasm because it is giving satisfactory performance continually, and adding new accomplishments to its record. Why not give STAR-MO M-2 a try-out in your shop?

Firth-Sterling



STAR-MO M-2 is Better

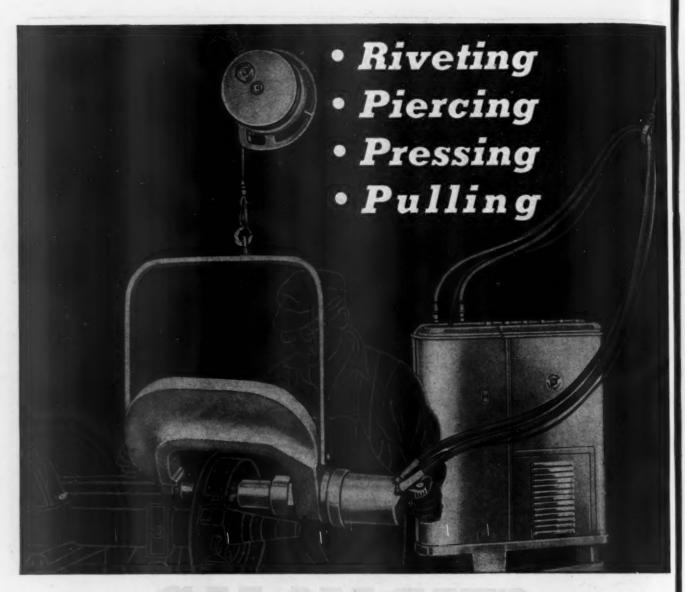
Outcuts and outlasts 18-4-1 high-speed steel on most applications.

STAR-MO M-2 Costo Leas

Base price is 14% less than 18-4-1 steels, and weight is approximately 7% less per foot. Let us quote.

STAR-MO M-2 is Easy to Handle

Call in a Firth-Sterling Representative to discuss applications, heat-treating methods and practical advantages.



## CP HYDRAULIC POWER MACHINE

DEVELOPING pressures up to 100 or more tons, CP Hydraulic Power Machine . . . comprising a self-contained generating plant and a CP Work Unit . . . speeds output and cuts costs in all types of high speed production riveting, piercing, pressing and pulling.

The self-contained CP Power Unit . . . with an electric motor-driven duplex hydraulic pump . . . will handle two, three or four CP Work Units operated one at a time. Or, the CP Power Unit will handle any number of CP Work Units operating simultaneously, up to the capacity of the hydraulic power unit.

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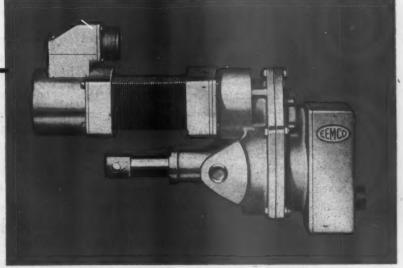




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# LINEAR ACTUATOR

ERHAPS you need a special electric motor to do a special job. Here's a typical self-contained unit designed from scratch by EEMCO to do a special kind of work. The main features of this linear actuator are these: 11/4 hp, 10,000 rpm - Equipped with magnetic clutch and brake -A double integral gear reduction unit operates screw jack actuator -Maximum load 3,000 pounds, with 21/2" travel on jack in less than 2 seconds - A control gear reduction drive turns cams for opening and closing specially developed limit travel switches -Frame 6230-C.



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ELECTRICAL ENGINEERING AND MFG. CORP.

4606 WEST JEFFERSON BOULEVARD . LOS ANGELES 16, CALIFORNIA

## THE EDITOR'S DESK

#### "HOW WE LIVE"

This era of mass production and vastly enlarged and expanded commerce has greatly improved our living conditions and economic welfare. But it has also complicated our relationships in the home, the school, the workshop, the mart and in government. As a result, and because we fail to understand the economic problems involved, we needlessly quarrel among ourselves when we should be intelligently co-operating with each other in the common good. We are paying extremely heavy penalties for this stupid and ignorant way of dealing with each other.

But you may say, "How are we to learn the pertinent facts about economics? We have tried to follow the text books prepared by learned professors, but they deal with all sorts of complications and in terms which we cannot readily understand. Indeed, we frequently wonder whether they really understand themselves what they are talking about."

That is the trouble! And it is multiplied by the fact that men engaged in business, agriculture, commerce and the professions, who should understand the basic principles of economics, seem to be too busy and preoccupied to pause and think them through.

A railroad chief executive, keenly aware of these conditions, has tried to educate the 2,000 key men on his system (officers and supervisors) in

these matters, particularly since they are of so great importance from a human relations stand-point. His latest move has been to arrange to furnish each of these key men with a copy of "How We Live", by Fred G. Clark and Richard Stanton Rimanoczy (Van Nostrand).

This book, which is designated as "A simple dissection of the economic body", is dedicated "to America's 50 million workers, in whose continued welfare lies the future greatness of our nation". Printed in large, clear type and with simple, understandable illustrations, it contains less than 5,500 words, with a vocabulary of only a little in excess of 700 words. It is easy to read and each word counts. Economics is reduced to its simplest principles and in a way which can be readily grasped and understood. It is developed out of five years' experience of the authors in conducting the "Wake Up America!" radio quiz debate, in which they have brought together liberals and conservatives "to dissect and analyze the roots of America's economic controversies". They have done a fine job.

Roy V. Wright



SEVERAL large railroads are using KING Boring Mills to overcome tire failures caused by rough and scaly bored surfaces at the wheel fit.

In one particular shop, roughing cuts are taken at a speed of 190 surface ft. per min. and rough and scaly bored surfaces at the wheel fit.

In one particular shop, roughing cuts are taken at a speed of 190 surface ft. per min. during the tire boring operations.

In one particular shop, roughing cuts are taken at a speed of 190 surface ft. per min. during the tire boring operations. In one particular shop, roughing cuts are taken at a speed of 150 surface ft. per min. during the tire boring operations.

The result is a mirror-like finish which assures a uniform tight shrink fit over the entire. finishing cuts at approximately 320 surface ft. per min. during the tire boring operations. fit over the entire uniform tight shrink fit over the entire uniform tight shrink fit over the entire uniform tight shrink fit over the entire uniform. The result is a mirror-like finish which assures a uniform for this class of work here. The result is a mirror-like finish which assures a uniform for this class of work here. The result is a mirror-like finish which assures a uniform tight shrink fit over the entire area. KING Heavy Duty Boring and Turning Mills are preferred for this class of uniform tight shrink fit over the entire and at a securacy and abundance of nower to take any cut and accuracy and abundance of nower to take any cut and accuracy and abundance of nower to take any cut and accuracy and abundance of nower to take any cut and accuracy and abundance of nower to take any cut and accuracy and abundance of nower to take any cut and accuracy and abundance of nower to take any cut and accuracy and abundance of nower to take any cut and accuracy and abundance of nower to take any cut and accuracy and abundance of nower to take any cut and accuracy and abundance of nower to take any cut and accuracy accuracy and accuracy accuracy and accuracy accuracy accuracy and accuracy acc area. KING Heavy Duty Boring and Turning Mills are preferred for this class of work because of their rugged construction, accuracy and abundance of power the economies built into
Be sure to investigate the economies built into cause of their rugged construction, accuracy and abundance of power to take any cut and at Be sure to investigate the economies built into any speed a modern cutting tool will stand.

Results and abundance of power to take any cut and at modernization.

Results and abundance of power to take any cut and at modernization.

any speed a modern curring root will stand. be sure to invest KING MILLS during your plans for post-war modernization. All available with or without side head.

# The KING MACHINE TOOL Company

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY CINCINNATI, OHIO

# How to Get Up-to-Date on 81/2" Air Compressors



Side View Showing Clearance



This view shows air cylinders with mounting pads for F-2 lubricator as now supplied for replacements. Conversion can be made by applying the lubricator and new top head.

The advantage of dependable, metered lubrication and the all-around improvement in compressor performance that stems from it is not limited to new compressors. The F-2 lubricator as well as the integral-mounted governor can be had for compressors in service by replacing the top head and the air cylinders. As shown by the clearance diagram above, these parts can be added to existing compressors and stay within existing clearances. To facilitate conversion all air cylinders are now made with the mounting pads for the F-2 lubricator.

# Westinghouse Air Brake Company

Wilmerding, Pa.

### RAILWAY MECHANICAL ENGINEER

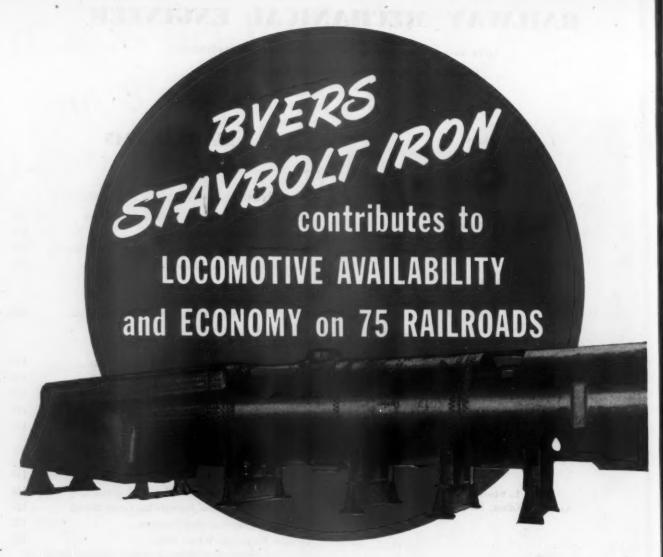
(Name Registered, U. S. Patent Ofice)
With which is incorporated the RAILWAY ELECTRICAL ENGINEER.

Founded in 1832 as the American Rail-Road Journal

Roy V. Wright
Editor, New York

#### **MARCH, 1945**

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This locomotive boiler, equipped with staybolts made from Byers Staybolt Iron, is something you might see in the shops of any of 75 railroads that have used the material. And each installation has meant protection of locomotive availability, and a substantial saving in dollars and cents.

The dependable service of Byers Staybolt Iron that has won this widespread acceptance is the direct result of the method of manufacture. Modern equipment and close control permit the duplication of physical and metallurgical qualities day to day and year to year. All material is twice piled, and all slabs run the full length of the pile. The total reduction between original blooms and staybolt blanks is over 50,000 to 1. Since rolling reductions directly affect slag distribution, this gives more uniform results than are obtained by any other means.

The savings from the use of Byers Staybolt Iron also come from the method of manufacture, which permits quantity production on a quality basis. Users have reported savings ranging up to 31/4 cents a pound . . . \$65.00 a ton. Multiply this by your annual requirements . . . and the total is impressive.

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A. M. Byers Company does NOT make staybolts, but supplies to your shop or your staybolt manufacturer. In specifying the material to be used in your next staybolt order, just say "Byers Staybolt Iron."

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

FORGING BILLETS. The same unusually high quality and uniformity found in Byers Staybolt Iron is duplicated in Byers Forging Billets—also at a material saving. They are produced in round, square or rectangular sections, under ASTM-A-73 and AAR-M-307 Specifications.

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GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

The Pennsylvania

# Geared Turbine Locomotive

THE pioneer direct-driven steam-turbine locomotive, now on main-line trials by the Pennsylvania for long-distance high-speed passenger and freight service, offers several inherent advantages to the industry. Compared to the two cyclinder reciprocating locomotive, the geared turbine drive provides: 20 per cent more power from a given boiler; smaller driving wheels and lower center of gravity; uniform torque without reciprocating parts, dynamic augment, and unbalanced forces. The power unit making possible these advantages for the first direct-connected steam-turbine locomotive in this country is the result of new and significant engineering advances. For example: (1) the power unit is a completely self-contained assembly; (2) a three-point support avoids transmitting frame distortion to the gear case; (3) a single small lever controls both speed and direction of the locomotive; (4) hardened and ground double helical gearing is used commercially for the first time; and (5) tooth loading of the high-speed pinion is practically double that ordinarily

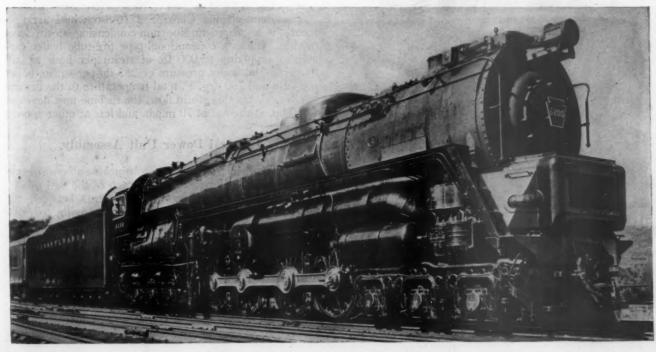
The reciprocating steam locomotive with Stephenson valve gear was introduced over a hundred years ago. Although it has been vastly improved in detail, its essential elements—fire-tube boiler, cylinders, valve mech-

By J. S. Newton\* and W. A. Brecht†

The forward turbine develops 6,900 shaft horsepower and drives through double reduction gears to quill gears on two axles—One-lever control

anism, and linkages, and driving rods—have suffered no fundamental change. Not that many innovations have not been tried. Locomotives have been built with water-tube boilers, compound engines and poppet valves. While some of them have been successful (and have been adopted), those that departed radically from the simple steam engine have not been adopted, either because they did not prove economical or because of mechanical inadequacy.

\*Assistant engineer manager, Steam Division, Westinghouse Electric & Manufacturing Company, South Philadelphia, Pa.
† Manager, Transportation Engineering, Transportation and Generator Division, Westinghouse Electric & Manufacturing Company, East Pitts-



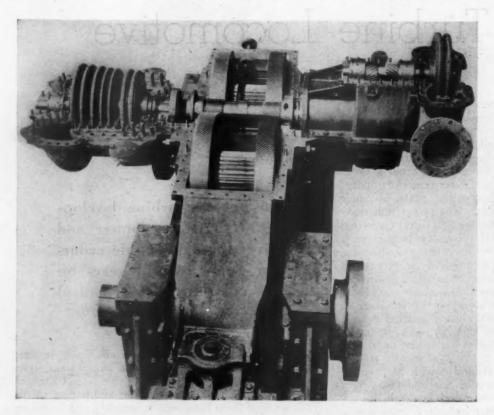
Railway Mechanical Engineer MARCH, 1945

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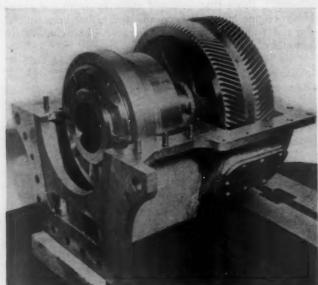
In 1937, the Pennsylvania became interested in the possibility of improving the performance of its standard passenger locomotive by replacing the single expansion reciprocating engines with a geared turbine. After two years of study, Westinghouse and Pennsylvania engineers were convinced that the performance could be greatly improved, and that a good mechanical design would result. However, the cost of making modifications

power locomotive for high-speed freight or passenger service. This rating was considered the greatest practicable for a rigid frame four driving-axle unit. Some material was on hand before our entry in the war, but construction was stopped and the design changed to utilize non-critical materials. This required a change in wheel arrangement from the 4-8-4 to the 6-8-6 type. Manufacture on a limited scale was again started in the



The transmission unit with the turbines in place — The contact surfaces of the hardened and ground double helical gearing are 450 Brinnell—The spur gears between the helical gears mesh with the axle gear

Penn



The slow-speed reversing gear and clutch mounted in the lower half of the overhung gear housing

to existing locomotives would be almost as much as the cost of a complete new engine. Therefore, a larger, new high speed locomotive was studied. Engineers of the Pennsylvania-Baldwin Locomotive Works, and Westinghouse completed the designs and late in 1941 proceeded with the construction of a 6,900 shaft horse-

second quarter of 1943, and the locomotive delivered by the Baldwin Locomotive Works to the Pennsylvania in September, 1944.

#### Geared-Turbine Drive

The Pennsylvania Class, S-2 (6-8-6 wheel arrangement) is a geared-turbine non-condensing steam locomotive. It has a conventional-type fire-tube boiler capable of supplying 95,000 lb. of steam per hour at 310 lb. per sq. in. boiler pressure or 285 lb. per sq. in. boiler pressure and 750 deg. F. total temperature to the turbine nozzles. With this steam flow, the turbine unit develops 6,550 hp. at the rail at 70 m.p.h. and less at other speeds.

#### Integral Power Unit Assembly

The propulsion unit and controls include a forward turbine, a double-reduction gear for each of the two middle driving axles, flexible cup-drive elements between the final drive gears and the two middle driving axles, a reverse turbine and gear unit clutched to the single high-speed pinion, a pneumatic steam-admission control with overspeed and low-oil-pressure protection, and oil-system auxiliaries including a cooler, magnetic and metal edge strainers, two turbine-driven pumps and control valves.

Both turbines are supported from the gear case which, in turn, is supported from the main locomotive frame, making the power unit a complete assembly in itself. The gear case is supported from the locomotive frame at

General Dimensions, Weights and Proportions of the Pennsylvania 6-8-6 Direct-Drive Steam Turbine Locomotive

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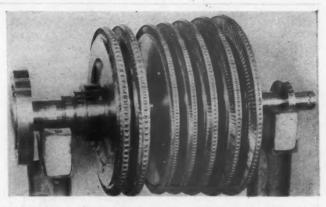
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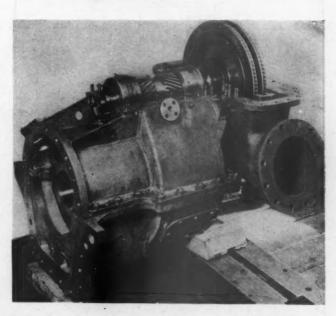
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Pennsylvania 6-8-6 Direct-Drive Steam Turbine Locom	otive
Railroad Pennsy Builder Pennsylvania-Westinghouse-B	aldwin
Type of locomotive	urbine
Road class	
Date built	1944 -
Service	freight
Tractive force; lb.: Forward	70,500
Reverse	
Weight on drivers + tractive force: Forward	
Forward Backward	3.69 4.00
Wheels, driving, diameter outside tires, in.	68
Weights in working order, lb.:	00
On drivers 2	60,000
On front truck	43,000 77,000
On trailing truck	80,000
Tender 4	49,400
Wheel bases, ftin.:	10 (
Rigid	19 - 6
Engine, total	53 - 0
Engine and tender, total	108 - 0
Steam conditions:	205
Steam temperature at inlet, deg. F.	285 750
Pressure at turbine inlet, lb. per sq. in. gauge	15
Nominal rated capacity, hp.  Maximum turbine operating speed, r.p.m.	6,900
Overspeed governor controlling speed, r.p.m	9,000 10,000
Reverse turbine:	1.500
Nominal rated capacity, hp.  Maximum turbine operating speed, r.p.m.	8,300
Overspeed governor controlling speed, r.p.m.	9,100
Main reduction gear: High-speed ratio	: 160
Low-speed ratio	: 111
Total reduction18.	5:1
Boiler: Type	elnaire
Steam pressure, lb. per sq. in.	310
Diameter, largest outside, in,	102
Firebox length, in. Firebox width, in. Combustion chamber length, in. Tubes, number and diameter, in.	96
Combustion chamber length, in.	120
Tubes, number and diameter, in	9 - 21/4
Length over tube sheets, ftin. 1 Net gas area through tubes and flues, sq. ft. 1	8-0
Net gas area through tubes and flues, sq. ft	1
Fuel Bitum Grate area, sq. ft	ninous
Vesting surfaces on ft :	~
Firebox and comb. chamber	530
Circulators (6) Tubes and flues	4.378
Evaporative, total	4,992
Superheater	2,050
Combined evaporative and superheater	7,042
Water capacity, gal	18,000
Fuel capacity, tons	371/2

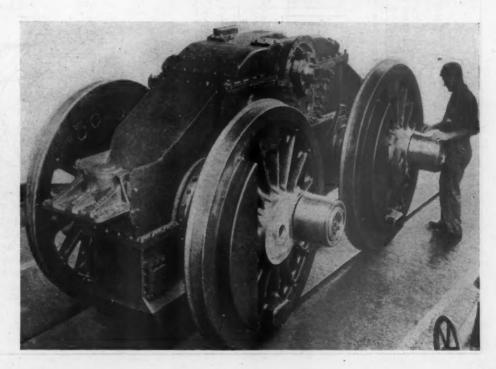


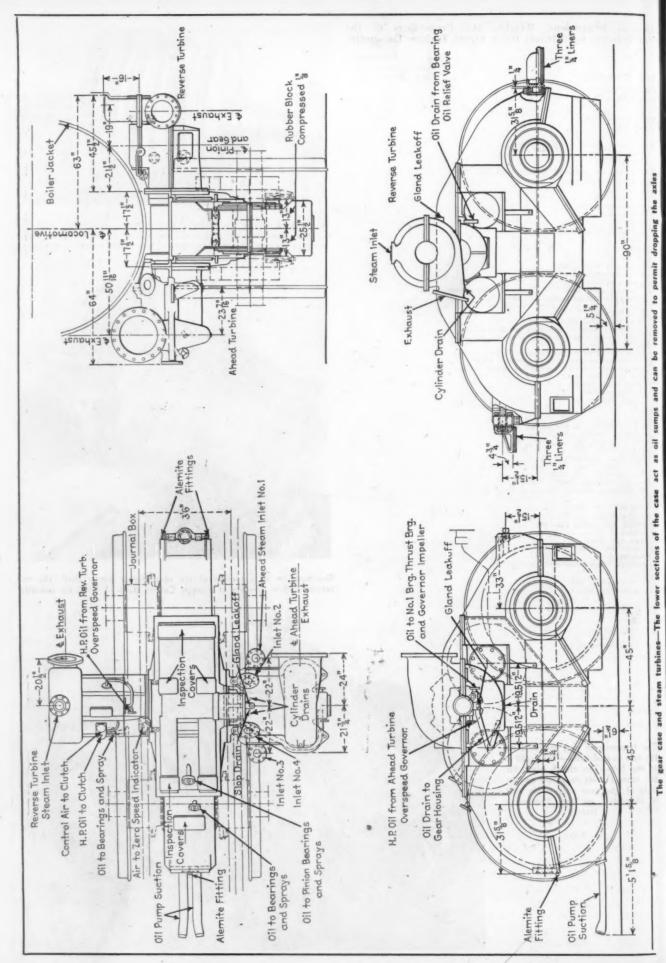
The forward turbine has an initial Curtiss stage (at the left) and five full-admission reaction stages—Cam-operated air valves control the steam to each of four nozzle groups—These valves operate in sequence



Overhung on an extension of the reverse-gear pinion shaft, the reversing turbine consists of a single Curtiss stage of 1,500 hp. capacity

The transmission unit mounted on the two geared axles—The front is at the left—The clutch plate for the reverse drive is shown on the right of the gear case—This unit is supported on the locomotive frames





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three points (two at one end of the case and one at the opposite end) in such a manner that distortion of the locomotive frame is not transmitted to the gear case.

The forward turbine is of the impulse type and consists of a Curtiss stage followed by five full admission Rateau stages. Although especially designed to meet the severe temperature and load changes found in railway oractice, it is similar to the high-pressure units of crosscompound marine plants. At 100 m.p.h. of the locomotive the turbine speed is approximately 9,000 r.p.m. It is connected to the high-speed pinion at the reverse-turbine side of the unit, a quill shaft extending through the pinion. Steam enters the turbine through four 3-in. pipes, each pipe being connected to a nozzle group covering approximately 25 per cent of the peripheral area of the Curtiss stage blading. Each inlet pipe is connected to a throttle valve and steam header located at the top of the smokebox. There are four cam-operated valves for control of steam to the forward turbine, each valve controlling the flow of steam to one of the four inlet pipes. The cams are arranged to open the valves in sequence. Close regulation of locomotive power and speed are obtained by opening each valve in small increments.

The reverse turbine is a single Curtiss stage, overhung on an extension of the reverse-gear pinion shaft. Steam is admitted to nozzles in both the base and cover of the reverse turbine cylinder through a single inlet pipe, connected to the reverse throttle valve, also cam-operated, and located adjacent to the forward turbine valves. The maximum locomotive speed in reverse is 22 m.p.h., at which speed the turbine develops 1,500 hp. at approxi-

mately 8,300 r.p.m.

The maximum starting tractive force in reverse is 65,000 lb., or 25 per cent adhesion. This is made possible with the small reverse turbine and only a third of the steam flow of the forward turbine by the addition of the reverse gear which multiplies the torque of the reverse turbine by four at the high-speed pinion.

Power in reverse is transmitted to the main-gear high-speed pinion through a hydrzulically actuated positive engagement clutch. The forward turbine is solidly connected to the high-speed pinion, but the reverse turbine is engaged with this pinion only during operation in reverse. Engagement or disengagement of the clutch when the locomotive is moving is prevented by a "zero speed" interlock in the pneumatic control circuit. The reverse turbine, the reverse gear and the movable clutch half are shown in two of the illustrations.

#### Single Lever Control

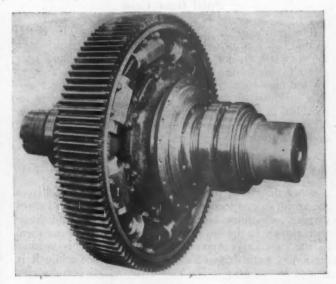
One lever at the right of the cab is used to control speed as well as direction of the locomotive. The complete motion of the lever is the same as that in shifting one's private automobile from "low" gear to "intermediate." The neutral position of the gear shift is the "off" position for the locomotive. Moving into "intermediate" controls the steam flow to the forward turbine; moving into "low gear"engages the clutch and controls the flow of steam to the reverse turbine. The control consists of a forward pneudyne (an air-relay-controlled pneumatic cylinder) located on the engineman's side of the locomotive, a reverse pneudyne on the fireman's side of the locomotive, overspeed and low-oil-pressure-protection valves and a zero-speed interlock. The pneudynes, through a rack and pinion forward and a lever in reverse, rotate the throttle-valve cam shafts and thereby control steam flow to the turbines. If either turbine over speeds (110 m.p.h. forward, 25 m.p.h. in reverse) or if the lubricating oil pressure falls below 5 lb. per sq. in., the

protection valve operates to close either throttle by exhausting the control air to atmosphere. The control was supplied by the Westinghouse Air Brake Company.

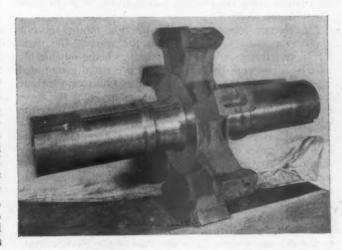
#### Unusual Gearing

The main gear is a double-reduction unit designed to transmit power to the No. 2 and No. 3 driving axles from a single high-speed pinion. Transmission of equal torques to each of the driving wheels is assured by side rods connecting the four driving wheels on each side. The gear is of the nested type with two double helical high-speed gears, two low-speed spur pinions, two low-speed spur gears, and two cup-drive elements all housed in an enclosed fabricated steel gear case. The high-speed pinion and the second reduction gearing is hardened and ground. This is the first commercial application of hardened and ground double helical gearing. The tooth loading and contact hardness (450 Brinnell) of the high-speed pinion are more than twice the values commonly used. The first reduction gears are hobbed from material also nearly twice the hardness commonly used.

The development of a method of grinding double helical gearing with the extreme accuracy required is the first



The main elements of the drive are a spider which is pressed and keyed on the axle, a quill which houses the axle with approximately 11/4 in. radial clearance, and the spring-cup assemblies eight of which are mounted around the inner diameter of the gear



The driving axle and spider—The arms of the spider are faced with Stellite plates

major advance in this type of gearing since the first gear was built by George Westinghouse in 1909. Grinding is effected with a flat wheel in combination with a hovel grinding rig designed and developed by the Westinghouse Steam Division. Although materials of the usual hardness might operate satisfactorily in an application of this kind, an additional factor of safety is introduced by the use of the harder, stronger gear-tooth material. Further development and use of this new grinding technique may make possible real savings in the weight and space of double helical gearing for many high-speed high-power turbine drives.

Bearings for the high-speed pinion and the high-speed gears are tin base babbitt lined. Clearance greater than usual are required for the high-speed pinion bearings because of their high rubbing velocity. The high-speed gear bearings are novel in that they rotate with the pinion and gear, being fitted into the hollow-bored low-speed pinions on which the first reduction gear wheels are shrunk. The bearings rotate upon trunnions which center the second reduction pinions. The low-speed gear bearings are of the anti-friction-type duplicate of those furnished as quill bearings for electric locomotives.

#### Split Gear Case

The gear case is split into four pieces. The center section is the principal structural member to which both the forward turbine and the reverse turbine and gear assembly are bolted. The upper section forms a cover for the high-speed gearing and contributes to the crosswise stiffness of the case. The two lower sections removable to permit dropping the axles are lubricating-oil sumps as well as enclosures for the low-speed gearing and the cup-drive assemblies.

#### **Cup-Drive Used**

Since the complete propulsion unit is supported from the spring-borne locomotive frame the second and third driving axles must be permitted to move up and down with respect to the low-speed gears which surround them as the locomotive moves over the rails. This vertical motion of each driven axle must take place while it is turned by its gear. The cup drive which permits this motion is really a misalignment coupling between the low-speed gear and the locomotive axle. This development is used on most main-line electric locomotives, and while the Class S-2 cup drive is the same in principle as the drives used on electric locomotives, it bears little resemblance physically.

On electric locomotives, the traction motors occupy almost the entire space between the wheels, the main locomotive frames and journal bearings being outside the wheels. The cup-drive assemblies are usually mounted in the plane of the driving wheels. On steam-turbine locomotives with side rods it is necessary that the locomotive main frame and the cup drive be between the wheels.

The Class S-2 cup drives occupy the centers of the low-speed gears and are on the longitudinal centerline of the locomotive. They are compact assemblies, as is shown by the photograph taken with the enclosing cover removed. The "quill" becomes two short seats on the gear center for roller bearings which are carried in the main gear case. There are two rows of cup assemblies, with eight in each row. Since the quill cannot extend to the driving wheels, as in the case of the electric locomotives, a drive spider is pressed on the locomotive axle, at its center, and the gear torque is transmitted by the

eight spring-cup assemblies to the arms of this spider.
Two major departures were made from conventional cup-drive design to enable the Class S-2 drives to withstand the heavy duty imposed on them by having to

transmit power to all four axles.

The cups are made in two pieces, with self-aligning inserts which distribute the spring loads over relatively large areas of contact with the drive spider arms. The whole drive is enclosed by oil-tight cover plates so that the entire mechanism is kept clean and well-lubricated with a bath of heavy extreme-pressure lubricant.

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The cup drives, in addition to permitting the up-and-down motion of the driving axles, are torsionally flexible. This protects the gearing and turbines from shock loads. It would also mean that, if the driving wheels on one of the two geared axles were larger than those on the other, that axle would tend to "hog" the load. To prevent this, and to force an equal division of power flow to each of the geared axles, side rods have been provided between No. 2 and No. 3 driving axles. All side rods on this locomotive are fully balanced, so that the dynamic augment inherent in reciprocating locomotives is eliminated.

#### Lubrication

All turbine and gear bearings and the gear feeth are lubricated with the same oil, a high-grade turbine oil having a viscosity of 500 sec. Saybolt Universal at 100 deg. F. The system contains approximately 150 gallons, and the entire quantity is recirculated by one of two small turbine-driven Gould centrifugal pumps. One pump is for normal duty and the second one is an emergency standby. Oil is pumped from the gear case through a magnetic strainer and oil filter to a surface-type oil cooler, cooled by boiler feedwater, and then to a distributing manifold equipped with a steam-heating coil before being piped to the bearings and gear sprays.

A regulator maintains a constant oil pressure of 15 lb. per sq. in. on the bearings and sprays. The pump discharge pressure is 60 lb. per sq. in., high-pressure oil being required for the hydraulic cylinder which is used

to engage the reverse clutch.

#### A Look Back and Ahead

The basic engineering ideas in the S-2 locomotives are the result of many years of study and development. Turbines have been applied abroad to steam locomotives. Some turbine locomotives have been successful and a few are still in service in Europe. Probably the most successful one is the 2,000-hp. non-condensing engine of the London, Midland & Scottish, placed in service in 1933. Since that time it has operated in express service between London and Glasgow over the same route as such famous trains as the Coronation Scot. The performance of this locomotive has been creditable. However, its power is insufficient to make it economically competitive with the efficient compound reciprocating locomotives used on the L. M. S. Locomotives for railroads in the United States require two or three times the power of those used in England, and American railroads use the less efficient but simpler and more reliable single-expansion engine. These factors make the turbine locomotive more attractive here than in England.

The Pennsylvania Class S-2 locomotive has been undergoing tests on the railroad in both passenger and freight service. Continued operation in revenue service is contemplated to prove fully the mechanical adequacy of the

design.

# Diesel Electrical Repairs

IT HAS already been pointed out that for various reasons maintenance programs and facilities for Diesel-electric locomotives in respect to Diesel engines and mechanical parts lagged a number of years behind the actual application of such locomotives to service. Probably due to the fact that electrical equipment has the inherent ability to keep going under such conditions quite a way beyond the economic limit for deferred maintenance, it was about the last to receive serious consideration in the way of programmed attention and the requisite facilities. Under the impetus of the wartime expansion in the use of Dieselelectric motive power, intensive study was given the matter of electrical repairs. It is, of course, true that some railroads have already installed the necessary facilities and a fortunate few (as previously mentioned) were already equipped for maintaining electric locomotives or multiple-unit equipment or both and thus could take on electrical work on Diesel-electric locomotives without

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There is the further fact that even had all the necessary facilities been generally available from the start, the methods to be used in the maintenance of the electrical equipment had in a number of important respects to be developed as dictated by service experience. This was particularly true in the case of Diesel-electric road locomotives. For example, who could predict what repair procedures would have to be adopted for traction motors and at what intervals when the motors were first used in high speed, streamlined train service? As a matter of fact, the design of these motors itself was by no means in final form at this stage. Hence the two basic factors necessary for estimating maintenance requirements—the service of the equipment and its design—were both upper train.

With millions of miles of service already accomplished and designs more or less stabilized today, however, the maintenance pattern has begun to take definite shape as illustrated by the following general comments applying to various major items of the electrical equipment, the treatment of which at shoppings is presumed to be along lines similar to those assumed for Diesel engines and locomotive mechanical parts.

### The Main and Auxiliary Generators and Exciters

Being directly connected to the Diesel engines and therefore located in the hoods or engine compartments, traction generators are subject to dust and dirt, oil fumes or smoke and relatively high ambient and cooling air temperatures. Depending on margin of design and load factor of the service, they may also be subject to high temperatures resulting from electrical loading. Having customarily a single outboard bearing, mechanical conditions may also be severe. Being directly connected to the prime movers in locomotives, a main generator failure is in itself serious since in the case of a single-power-plant locomotive it ties up the entire locomotive and in the case of multiple-power-plant locomotives it will cause at least a substantial reduction in capacity, and it may involve the engine itself in serious damage. Under these

\* General mechanical superintendent, New York, New Haven & Hartford, New Haven, Conn.

By P. H. Hatch\*

An outline of the facilities required for the maintenance of the electrical equipment of Diesel-electric locomotives and the methods that are used —This completes a series of three articles the first of which appeared in the January issue

conditions the only answer to satisfactory main generator performance is close attention in service and adequate

maintenance at shopping times.

The amount of such maintenance work which should be done at one time varies between switching and road locomotives and in both cases depends also on the severity of service. Particularly in the case of switching-locomotive main generators, a program of thorough cleaning of armature and field, painting of armature string band, checking of field-coil and brush-holder connections with necessary retaping and painting, detailed inspection of brush holders and brushes with necessary repairs or replacements, general inspection of commutator, checking of bus bars or leads and testing can be adopted to alternate with a heavier program. All of this is work which can be done without removing the generator from the engine.

The heavier program requires removal of the generator from the engine and its complete dismantling. The principal purpose is to turn the commutator, inspect, clean and repack the roller bearings, examine the bearing housing in the end frame and thoroughly clean both armature and field windings by wiping or the use of a suitable solvent, using compressed air with care and being sure to remove all traces of solvent, dipping and baking armature and field as necessary and rebanding the armature. This constitutes a medium-heavy-repair job and is usually done when the commutator requires turning. It, of course, includes the work done in connection with the

lighter, intermediate class of repairs.

It is possible to avoid dismantling the generator by turning or grinding the commutator in place. While in many cases this is standard practice, it is believed that more accurate and uniform results can be obtained by turning and polishing in a lathe, thus conserving commutator material and prolonging its life. This method, while admittedly taking longer and being more costly, affords the further advantages of being able to check the main bearing and to clean insulation thoroughly and dip and bake if required.

Regarding the latter, it is considered better practice to dip and bake only if the condition of the insulation requires this treatment, otherwise resorting to cleaning and possibly a light spray coating of insulating varnish (or, in the case of the armature, a "rolling" in such varnish) only. Needless dipping and baking adds useless material to the windings which will decrease heat transfer and reduce the area of ventilating air passages. As to how to determine whether dipping and baking is required, usually detailed inspection by an experienced man in conjunction with megger readings is all that needs to be done.

In the case of generators in road locomotives, the intermediate lighter program of repairs will usually be omitted in favor of the heavier program which will be required more frequently than in the case of switching-locomotive generators because of more continuous heavy duty. Thus, at certain intervals determined by commutator conditions or other considerations, the generators will be given repairs in accordance with the heavier program described.

Complete rewinding of generators, renewal of commutators, etc., in the absence of fires, major insulation failures, bad flashovers or mechanical damage will be a long-term necessity, assuming proper and adequate design in the first place. What this long-term period will actually turn out to be is at present more or less indeterminate.

One of the most controversial subjects in connection with electrical repairs is high-potential testing of insulation dielectric strength to ground and this problem is very much present in connection with the maintenance of main generators on Diesel-electric locomotives. Under the effects of heat, dirt or moisture, or a combination of these, strength of insulation deteriorates in service and it becomes a two-fold problem in any repair program. One part of this problem is testing before repairs are made to determine if any special work is necessary or if there are any weaknesses present, and the other part is testing after repairs to make sure the generator is in suitable condition for the normal period of service before the next shop attention. The ultimate solution is usually based on the manufacturer's experience and recommendations modified by the railroad's own experience and service results. It goes without saying that it is uneconomical to break down insulation needlessly and it is equally uneconomical not to determine as far as possible by test the condition of the insulation before release from repairs. In this connection, it may be found of material assistance in working out a scale of test highpotential values to use to base them on preliminary insulation resistance values determined by megger readings. Thus any machine or winding not having the prerequisite insulation resistance would not be subjected to a high potential test voltage which in all probability could be expected to break it down.

Before leaving the subject of testing, mention should be made of high-frequency testing to determine the strength of insulation between turns, which is especially useful when applied to apparatus which has been rewound.

Auxiliary generators are low voltage machines either directly connected to the main generator or belt driven from the Diesel engine or its auxiliaries. By means of voltage regulators their voltage is held constant over a wide range of engine speeds. While in a number of earlier switching locomotives they were called upon to furnish all locomotive power, including that for radiator fan motors, air compressor or compressors, traction-motor blowers, battery charging, control, excitation and miscellaneous small motors, in later designs of both road and switching locomotives they furnish power only for battery charging, control, and miscellaneous small motors and their size has, therefore, been correspondingly reduced.

Auxiliary generators require the same kind of repairs as already described for main generators, but being of small capacity and low voltage, such repairs are needed only at extended intervals and they can usually be taken care of in connection with the occasional repairs of the heavier type to main generators.

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With the exception of a series winding carrying main generator armature current (if used) exciters are also low voltage machines of small capacity. They are usually belt driven from the Diesel engine or its auxiliaries and the same general repair considerations apply as for auxiliary generators.

#### Motors - Traction and Other

With few exceptions, traction motors are axle and truck mounted and the drive to the axle is by means of a single pinion and gear enclosed in a gear case. Spring support on the truck-frame cross member or centerplate assembly is usually provided for the motor nose, and the opposite side of the motor frame includes two housings for bearings which rest on journals on the axle between the gear and the opposite wheel. Usually the motors are force ventilated through ducts in the body and truck center plate assemblies.

From these facts certain conditions are immediately apparent. Traction motors are only half spring supported and are therefore subject to a combination of direct and spring damped blows. They are exposed to all of the heat and dust of the roadway or yard at various times and to snow or moisture at other times. In accordance with present design arrangements, cooling air is usually taken from the hood or engine compartment and hence may include dust and dirt, oil fumes or smoke and may also have a relatively high temperature to start with. It can thus be seen that if the locomotive—either switching or road type—is to be operated at its full rated capacity for any length of time under these conditions, design of traction motors must be adequate in the beginning and maintenance must be adequate thereafter if satisfactory service is to be obtained.

While it is necessary to recognize a distinction between traction motors used in switching locomotives and those used in road locomotives this tends to involve different periods or time intervals rather than maintenance procedures. For example, the work done by a traction motor in a road locomotive is many times that done by a similar motor in a switching locomotive over a given period, and hence more frequent and active attention is required. The kind of repair attention, however, is generally similar and will be discussed here.

Probably the three most important factors governing traction-motor repairs from the standpoint of either time intervals or type of repairs required are cleanliness, roller bearings and commutators. Any service factor, therefore, which affects any one or all of these items will affect the entire maintenance picture for motors in that service. Conversely, the maintenance program must take these three factors into account and prevent trouble which might develop from any or all of them.

Traction-motor repairs, therefore (as distinguished from current routine attention and eliminating such longterm items as complete rewinding, renewal of commutators, etc.), will be along the following lines:

On removal from the trucks the motors must be dismantled for detailed examination of commutator, armature winding, field windings, brushholders, connections, leads and armature roller bearings and their housings. All oil and dirt must be removed by wiping or by the use of a suitable solvent, using compressed air with care,

and being sure to remove all traces of solvent. Restore commutator surface, preferably by grinding; dip and bake both field and armature as necessary and reband the latter. Inspect brushholders and make necessary repairs and check over all connections and leads, cleaning them as required. Examine armature roller bearings and clean and repack. On completion of repairs and prior to reassembly, the armature should be dynamically balanced if the motor is of the modern, high-speed type and used in road service. Axle bearings should be inspected and rebabbitted or renewed.

In the foregoing it is, of course, understood that if a motor has sleeve armature bearings these should be renewed or rebabbitted as required, and the armature-shaft

bearing surfaces should be checked.

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The same comments apply to dipping and baking of traction-motor windings as for similar main-generator parts, also the same considerations apply to dielectric testing before repairs and after repairs are completed. Regarding commutator grinding, methods have been developed for doing this with the motors in place in the locomotive. While this may serve as an emergency means for restoring commutator surfaces in service without having to remove and dismantle the motors, it is not recommended as a shopping procedure.

When a traction motor has gone through repairs of the type just described, some railroads prefer to run them light at reduced voltage before installation in trucks for the purpose of checking operation and to detect any in-

cipient bearing trouble.

In the case of locomotives with electrically driven auxiliaries, the radiator-fan motors, air-compressor motors and traction blower motors should receive the same general type of attention as described for auxiliary generators and exciters, the intervals at which such attention is given varying with the service the locomotive is in.

Fuel-transfer-pump motors, water-transfer-pump motors, motor-generator sets, steam-generator main motors, etc., should be removed for reconditioning, or should be replaced with reconditioned units at the shopping times

of these units.

#### Control Equipment

Reversers should be removed for dismantling, cleaning, lubrication, and repairs. Piston packing should be renewed, pinions and racks examined for wear and magnet valves cleaned and tested. Contact segments should be renewed or built up and re-machined. Stationary contacts, shunts and springs should be inspected for overheating or wear and replaced as necessary. Contact tension should be checked and adjusted and interlocks inspected.

Contactors should likewise be removed for dismantling, cleaning and repairs. Tips should be dressed up or renewed, arc chutes should be repaired or replaced and interlocks inspected. Insulators should be cleaned and moving parts checked for wear. If of the electropneumatic type, piston packing should be renewed, cylinder walls lubricated, and magnet valves cleaned and tested. If of the electro-magnetic type, the operating coil

and its connections should be inspected.

So many important locomotive functions depend on relays and regulators that it is good practice to remove them for thorough inspection and repairs, afterward adjusting them on a bench or test panel for proper pick-up and drop-out values of current or voltage in the case of relays or for holding the correct range of voltage in the case of voltage regulators.

Voltmeters, ammeters or load indicators should be removed for steaming, testing and calibration. This should

apply also to engine or locomotive speed indicators of either the mechanical or electrical types.

Master controllers, push buttons, knife switches, etc., can be inspected and necessary repairs made on them without removal from the locomotive. Contact fingers and contact surfaces should be checked and necessary repairs or replacements made. The mechanical portions of the master controller, including the automatic safety feature, if used, should be inspected for wear and reconditioned if necessary.

Resistors should be inspected in place in the locomotive. Such inspection should include checking for over-

heating, poor connections or broken elements.

It is extremely important that cables and wiring be thoroughly inspected whenever a suitable opportunity presents itself in order to keep them free of collections of oil, grease and dirt and to repair insulation defects as they occur. This includes insulated bus bars as well as cobbs and wires and it applies of course to exposed sections and not to cables or wires in conduit. In the latter case reliance as to condition must be placed in the results of megger and high potential tests. Cleaning should be done by wiping with rags or the use of a suitable solvent; if a solvent is used, as mentioned in connection with repairs to main generators and traction motors, all traces must be removed. When the cleaning is completed, it is good practice to paint accessible sections, particularly those exposed to dirt, with a good grade of insulating paint which if possible should add to the moisture resisting and flame retarding properties of

If any section of cobbs or wiring is found to have deteriorated excessively due to heat, it would be wise to consider relocating to reduce such exposure, as heat is

one of the principal enemies of insulation.

Train-control or cab-signal equipment (electrical portion) will require general and specialized attention in accordance with the manufacturer's and individual railroad's requirements for electrical equipment of the type involved which is generally in a different category from other locomotive electrical equipment.

#### Conclusion

From the discussion of repair facilities for making mechanical and electrical repairs for Diesel-electric locomotives in this and the preceding two chapters it is apparent, in the first place, that a few items of heavy equipment conventionally used for railroad motive power are required, supplemented by a greater number of specialized smaller tools. It is apparent, in the second place, that the difference between a Diesel-electric shop equipped for running repairs and one equipped for repairs of a heavier or more extensive nature is principally one of degree and that a running repair headquarters can readily be designed to be expanded for heavier and more general repairs with a reasonable addition of tools and equipment. This is particularly true if manufacturer's "repair and return" facilities or their district service depots are utilized for the larger items of equipment. It is apparent, in the third place, that Dieselelectric locomotives by their construction and arrangement as an assembly of separate, integral parts lend themselves readily to a system of expedited, economical maintenance. And finally, given suitable and adequate design of locomotives and parts, it is apparent that the combination of preventive attention, proper facilities and correct methods can entirely remove maintenance as an unsolved problem in the use of Diesel-electric motive power.

# OVER THE HILL WITH A DIESEL

#### By Walt Wyre Part II

NED SPARKS watched the smoke of the passenger train fade into the distance and felt very much alone. The big 5400 horsepower Diesel was very silent. Every engine was dead. As long as Sam Wallace from the factory had been along, shooting troubles had seemed simple, but working alone made the job seem formidable.

Sparks looked at his watch—12:50. The locomotive was called for 1:35. The crew would be on it in thirty minutes or less. Sparks took a long breath and remembered what Wallace had reminded-don't ever get in a rush or panicky. Having thus bolstered his morale, Sparks began to do a little reasoning with himself. The alarm bells weren't ringing. Must be a blown fuse, he thought. He tested control circuit fuses in each unit and before he had finished testing them knew he was on the wrong track, because if one of them had been blown it would only affect that unit. Perhaps the control fuse at the switch in the cab was blown occurred to him. He tested that. It was O. K. After Sparks had replaced the fuse he sat down in the engineer's seat to think a moment. While sitting there he noticed the controlswitches, fuel pump switch closed; control switch closed; generator field switch open. That was as it should be. Of course it would be necessary to close the generator field switch before the locomotive would operate. His foot had been on the "dead man" control pedal. He rose to look in the engine rooms again. When he did he lifted his foot.

Sparks was opening the engine room door when he realized that there had been no whistle when he lifted his foot from the dead man control pedal. Then he was glad Wallace had not seen him. Any one should have known that the "dead man" had operated, which caused pneumatic control (P C) switch to open, stopping the fuel pumps, which caused the engines to die as they ran out of fuel.

The resulting opening of the control circuit was the reason the bells didn't ring as they had that morning when the overload trip operated and killed one of the engines.

Sparks set the air, then reset the P C switch and started the engines. He had the last one running and on the line when the engineer arrived. He then checked fuel, lube oil, and water. All were O. K.

By COINCIDENCE, both the engineer and fireman were named Jones and not related. The fireman's first name was Frank, the engineer's was Earl. "Are you from the Diesel factory?" the engineer asked Sparks.

"Hell, no!" Sparks answered quickly. "I'm just a dumb electrician from Plainville. Have you had much experience on Diesels?"

"Very little on passenger and none on freights," the hogger grinned, "but I guess we'll get up the hill all right, and I know we can go down the other side. Guess our train is ready, the brakeman is giving me a back-up signal."

Spa cab

"If you'll show me about the shutters and fans," the

fireman cut in, "I'll get them set."
"Good Lord!" Sparks groaned under his breath, "that

makes our ignorance unanimous."

The engineer backed on to the train, the air was tested, and they were all set to go. The conductor came up carrying a sheaf of orders.

"How many buggies have we got?" the engineer asked. "Sixty-nine," the conductor consulted a slip of paper, "thirty-one hundred and seventeen tons. Do you think you can make it with the 2842 helping?"

"Don't know," the engineer shoved the reversing lever

into forward position, "but we can try."

The first twenty miles out of Sanford on the Mountain Division is not steep, then at Mountain View it takes off with a two per cent grade; twelve miles further the tunnels start, twenty-six of them including the big tunnel at the top over three miles long and up hill all the way.

Leaving Sanford, Sparks went through the engine rooms with the fireman and showed him about opening and closing the shutters. Wallace had instructed the previous fireman to leave both fans in and all shutters closed while the locomotive was standing. It had cooled off considerably from the time the engines died and Sparks came up, but was still warm enough for moderate work as it would be doing getting out of the yard.

erate work as it would be doing getting out of the yard. "Never having been over the hill on a Diesel before, I can't say how the shutters should be," Sparks told the fireman, "but my idea is starting out about two shutters should be open, then when we hit the heavy grade at Mountain View I expect you will need to open another. It may take all four shutters open going up the hill. You can watch; if the engines start warming up, open shutters just a little at the time and the other way around if they start running too cool. One hundred and sixty-five is correct, I believe, and not lower than one-fifty nor more than one-eighty. The bells start ringing at two hundred."

"I'll watch them," the fireman promised.

Sparks walked through the engine rooms twice between Sanford and Mountain View. Everything seemed to be working smoothly and he sat down in the rear cab and began studying an instruction manual. He was reading the book when the train started up the heavy grade, but didn't notice it until he glanced at the speed indicator. It showed about thirteen miles an hour and the transition meter hand was way over to the red portion of the meter. Sparks went along as rapidly as possible to the front cab.

"What's the matter?" Sparks asked the hogger.
"We're not doing so good."

"This is about as fast as we usually make it along here." The engineer didn't appear to be bothered.

"That may be O. K. for a steam engine," Sparks said, "but at this rate the traction motors are likely to get too hot. Do you suppose you could signal the engineer on the helper to shove a little harder?"

"Not much chance," the engineer said. "What do

you think I'd better do?"

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"Maybe you had better drop the throttle down in the seventh notch and get the transition meter out of the red," Sparks suggested.

"I'll drop off and catch the rear end and tell the engineer on the helper," the head brakeman who was in the

"That's a good idea," the engineer remarked.

A few minutes later the brakeman had evidently told the helper engineer. Train speed began to pick up. Diesel engineer advanced the throttle to the eighth notch and continued to gain speed until the train was moving sixteen miles an hour and the transition meter hand well out of the red.



Hot air that stung nostrils and lungs rushed in

TT WON'T be long until we hit the tunnels," the engineer said a little later. "If there are any doors or windows open, better close them going through the tunnels

to keep out smoke and gas."

Sparks went back to the rear cab to close the windows which were open. As he went through he looked at the oil pressure gauges and thermometers. The fireman seemed to be doing fairly well for a new man. Temperatures were around 165 degrees, the highest was under 170.

Sparks closed the windows of the rear cab and picked up the instruction manual. He was looking at a schematic diagram of the control wiring tracing the control interlock circuits when suddenly he was in the dark. They had reached the first tunnel. He reached around back of him, his hand fumbling for the cab light switch, but before he found it the locomotive was out of the tunnel.

It was very hot and stuffy in the cab and Sparks decided to go to the front end where perhaps it would be more pleasant. By the time Sparks had entered the engine room the locomotive was passing through another The room became stifling hot in just a few seconds. Reverberation of the engine exhausts against the roof and walls of the tunnel intensified the noise until the sound waves seemed like something solid bom-

barding his ear drums.

For the first time in his life Sparks felt a panicky touch of claustrophobia, the fear of being closely confined. Instead of looking at oil gauges and thermometers as he had intended, he rushed towards the head end of the locomotive, By the time he had gone through two units light showed through the windows, the engine noise became normal and Sparks opened a side door and gulped a lung full of air fresh and cool from the mountains. Temperature of the No. 2 unit was slightly over 170 degrees, while that of the number one was a little lower.

'How are they running?" the fireman asked when

Sparks entered the cab.

"Look O. K.," Sparks replied, "that is the first two. To tell you the truth, it was so hot and stuffy in the rear units coming through the tunnel that I didn't stop long enough to look at the temperatures, but they have all been running about the same so far."

"She sure runs nice," the engineer said. "We've been making between sixteen and seventeen miles an hour ever since the helper picked up his feet and started push-We'll have to stop at Ozona for the helper engine to take water. Guess we won't need water this trip," he added.

It was decidedly more comfortable in the front cab than in the rear. Besides being cooler there was no smoke and gas, and Sparks was beginning to enjoy the ride. He had been over the Mountain Division before, but never in the front cab of a Diesel where he could get such a broad view of the rugged mountains and deep valleys. Patches of snow on the mountains ahead showed how rapidly they were gaining altitude and the scrubby cedars gave way to pine and fir with patches of scrub oak. A tumbling mountain stream dashed itself into a froth against the rocks as it rushed crookedly down the mountain side. The track following close to Nature's survey was almost as crooked as the stream. Once Sparks looked out of the window and glimpsed the rear end of the train and the helper engine going in the opposite direction to the Diesel. At first he thought it was another train they had met.

"Three miles to Ozona," the engineer remarked. "The next tunnel is the longest one we have until we get to

the top. It's nearly half a mile long."

THE mouth of the tunnel mentioned could be seen across a curve. The hole looked awfully small viewed at an angle. About half way through the tunnel the bells started ringing steady and insistent. Sparks and the fireman both started at once, Sparks in front, the fire-man following. Inside the engine room the bell was louder. The hot-engine light gleamed. The thermometer of the first unit stood below 165 degrees. The second unit was about five degrees hotter.

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As before, when passing through a tunnel, the noise and heat filled the engine rooms, but Sparks, intent on the job at hand, was not so affected. As they progressed towards the rear the heat became more intense and thermometers showed correspondingly higher. The third unit was approaching the danger mark, the hand stood

at 190 degrees.

"Must be the fourth unit," Sparks yelled and pointed, The engine noise shoved Sparks' words down his throat,

but the fireman understood the gesture.

It was the fourth unit. The thermometer hand had passed 200. Three shutters were open. Sparks opened the fourth wide as the lever would allow, but the bell continued to ring. The fireman stood helplessly watching, then trying to do something helpful opened a side door. Hot air that stung nostrils and lungs rushed in.

The fireman hastily closed the door.

Opening the fourth shutter apparently had no effect. The bell continued to ring. The hot-engine light still shone and instead of going down the temperature continued to go up. Sparks remembering what Wallace had told him that no harm would be done by the temperature reaching 200 was not much worried and two or three degrees more wouldn't matter, he figured, until he noticed that water in the gauge glass had dropped about three inches. Then he pulled the lay shaft lever bringing the engine to idle and threw the isolation switch taking the engine off the line. The train immediately began to slow down. The alarm light went out and the bell stopped ringing when the isolation switch was thrown, but started again in about thirty seconds.

At first Sparks couldn't figure why the bell started ringing, then he remembered that the third unit was getting hot when he came through it and in the rush neither he nor the fireman had thought to open the shutter. Sparks went rapidly as he could walk and opened the The water glass still showed full, for which

he was thankful. By then the locomotive was through the tunnel and the third unit began cooling immediately. stopped ringing and the light went out but the train had slowed almost to a crawl.

Sparks went back to the fourth unit which was still off the line and the engine idling. The water glass showed slightly over half full and about four inches above the low water level mark.

Sparks hesitated, then decided to put the engine back on the line before the train was stalled. Holding the lay shaft lever to allow the unit to pick up the load gradually, he threw the switch.

"How far is it to Ozona?" Sparks placed his mouth close to the fireman's ear and yelled.

"Little over two miles," the fireman told him.

"Any more tunnels?"

"Yes." the fireman nodded and held up two fingers. "Short ones," he managed to make Sparks understand.

Sparks opened the two side doors to allow fresh air into the engine room. He looked at the thermometer. The hand was down below 180 degrees, but when the engine had gained full speed the water in the glass dropped two inches below half way but it was still above the low level mark.

The locomotive with all units working soon regained the lost speed and was doing nicely up the hill. They came to another tunnel and while going through it the temperatures of the fourth unit rose a few degrees but not enough to hurt.

The tunnel was as the fireman had indicated short and they were soon through it. The fireman went back to the front cab but Sparks decided he had better re-

main and watch the fourth unit.

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Sparks will never forget that two miles to Ozona. Accustomed to mile a minute speed on the Plains Division, the torturous sixteen miles an hour seemed painfully slow and the ten minutes it took by the time the train stopped at Ozona seemed over an hour.

"We will have to put some water in the fourth quar-

ter," Sparks told the engineer.
"Well, guess we had better pull up to the tank," the engineer said. "How do you put it in?"

"I'll need a hose," Sparks told him, "but I guess they have one that is used for washing out ash pans.

There was a water hose at the tank but it had an iron pipe on the end to use for washing out ash pans. It took several minutes to remove the pipe so the hose would fit over the engine filter pipe underneath the car.

Having been cautioned about filling a hot engine with cold water, Sparks just partially opened the water valve and let the water run very slowly. It took thirty minutes to fill the tank, then fifteen minutes more for the engine

to get warmed up.
"How is it from here to the top of the hill?" Sparks asked while waiting for the fourth engine to warm up.

'Not as bad as we have come over, there are more tunnels but no long ones until we reach the big one. It has fans to blow the smoke out."

THEY had no more trouble until the big tunnel. The fourth unit wasn't quite up to 150 degrees when they left Ozona. When it got to 155 degrees the fireman opened all shutters wide and did the same on the third. The second unit ran cool enough with three shutters open while the first only required two open the rest of the way up the hill.

Signal lights approaching Climax where the tunnel begins indicated they should take the passing track. When they pulled up to the tunnel the block was red. The brakeman climbed down and went to the telegraph

"There's a Mallet with a helper going through now," the operator told the brakeman. "You can follow soon as they get out."

"Ain't they going to blow the smoke out of the tunnel before we start?" the engineer said when the brakeman told him. "Why, the smoke will be so thick you can't cut it with a knife."

But evidently they were not going to wait to blow the tunnel. The signal light changed from red to yellow. The engineer swore, gave two toots of the whistle and

reached for the throttle.

Smoke in the tunnel was like a solid wall moving before the Diesel. The headlight beam could not pene-trate the murk. The train gained speed slowly. The engineer opened the throttle a notch, the wheel slip indicator light flashed. The train was only moving about ten miles an hour with the throttle in the sixth notch and each time the hogger tried to advance the throttle the wheels would slip. At one time the wheel slip light stayed on several seconds.

"Do you suppose we can make it?" Sparks asked. "Don't know," the engineer shook his head dubiously.

"There's a lot of smoke in here."

"What does the smoke have to do with it?" Sparks glanced at the speed indicator which still showed only ten miles an hour.

"Smoke has a lot to do with it." The engineer tried another notch on the throttle, but went back to the sixth to stop the wheels from slipping. "Coal smoke sixth to stop the wheels from slipping. "Coal smoke on the rails is just like grease. I've stalled with a steam locomotive and had to back out and wait for the smoke to clear before I could get through," he added.

Sparks stood behind the engineer watching the instruments. Every instant he expected an overspeed trip to operate and kill an engine which would no doubt have happened if the throttle had been in the eighth notch instead of the sixth. Anyway, they made it through the hole and every one in the cab sighed with relief when a winking signal announced they were approaching the end and topping the Continental Divide.

At Hillside, terminal of the Mountain Division, Sparks was relieved for rest and he was ready. He had been on duty nearly twenty hours and under nervous tension.

It was almost noon when he woke. Some one was knocking on the door.

"Come in," Sparks invited sleepily.

It was Sam Wallace. He had come around from the other direction on a Diesel pulling a troop train. "How did it go?" Wallace inquired.

"Not so good," Sparks lighted a cigarette. "We lost forty-five minutes taking water on the fourth unit at Ozona." Sparks told him about the trip up the hill, then added, "but I learned at least two things: the rear units get hotter going through tunnels, and, believe it or not, smoke in a tunnel can stall a locomotive."



Photo from Bureau of Locomotive Inspection

An overheated crown sheet on a freight locomotive caused the deaths of three employees—The explosion threw this boiler 304 ft.



Truck with friction contacts eliminated which was installed on Milwaukee coaches built in 1942

Milwaukee Develops

# High-Speed Passenger Trucks\*

In 1934, when the Chicago, Milwaukee, St. Paul & Pacific built its first streamline Hiawatha passenger train, which was placed in service May 29, 1935, more attention was given to the body construction and its appointments than to the trucks. Therefore, a conventional four-wheel truck was employed which proved to be lacking in riding qualities, particularly at high speeds. The four-wheel equalized truck with helical and elliptical springs, used under this equipment, is illustrated herewith.

As the need for an improved passenger truck was recognized in the following year, or in 1935, an experimental program was started, but, as no satisfactory solution had been found, the passenger cars built by the Milwaukee in 1936 were also equipped with conventional four-wheel trucks with minor improvements such as the use of more

resilient springs.

Early in our experiments we found that personal judgment as to riding qualities could not be depended upon as conclusive, even from an experienced observer. Therefore, recording instruments were used and, in order to observe more closely the action of the truck at various speeds and service conditions, one vestibule step was removed and replaced with an observation booth from which also slow motion pictures were taken. Standard coaches were used in all instances and the final tests were made on both the main line and branch lines under customary

By K. F. Nystrom

Present-day demands are met by four-wheel roller-bearing trucks - Rubber cushioning reduces friction and aids in lowering noise level in cars

operating conditions. By conducting these tests under such conditions we were able to duplicate closely a given test, particularly as we had a traveling engineer or a representative of the test department in the locomotive cab to cooperate with the locomotive engineman as to desired speeds. While the tests were being conducted the test coach was not made available to the public, as a number of instruments were used and it was necessary for the test crew to keep various records including recording of mile posts, location, speeds, etc.

When we felt the truck design was the best that could be produced at the time, the test coach was put in passenger service between Chicago and Mineapolis on the regu-

lar high-speed Hiawatha trains.

At that time there were strongly divided opinions

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<sup>\*</sup>This article is an abstract of a paper presented at the railroad session of the A. S. M. E. annual meeting, Railroad Division in New York.
† Mechanical Assistant to Chief Operating Officer, Chicago, Milwaukee, St. Paul & Pacific. Mr. Nystrom's title has recently been changed to chief mechanical officer.

throughout the country as to a choice between four-wheel and six-wheel trucks. We had selected the four-wheel truck because of the saving in weight; others used sixwheel trucks. To obtain some first-hand information, we made several test runs with a coach equipped with conventional six-wheel trucks. After this test was completed, the center pairs of wheels were removed from the test trucks and that portion of the load that had been carried by the two pairs of equalizers to the center pair of wheels was transferred to the outer pairs of wheels by the use of a special equalizer 11 ft. long, extending between the outer wheels. With the exception of applying larger axles, no other changes were made. Tests were duplicated with this four-wheel truck, but no difference in riding qualities could be observed when compared with the six-wheel test truck. These tests also demonstrated that an 11-ft. wheelbase four-wheel truck rode no better than an 8-ft. fourwheel truck already in service and previously tested. There was a preference for the four-wheel arrangement as its noise level was slightly reduced.

At this point it may be well to mention the great difficulty one person or a single railroad has in coming to logical and correct conclusions in tests or research of this kind as, at best, due to other pressing duties, only intermittent time and attention can be spared. Time is lacking to analyze test results carefully and premature and incorrect conclusions may be reached. As an example, in 1915, while with the Grand Trunk in Montreal, I developed a clasp-brake truck which was later extensively used. I strapped myself to a vestibule coach step for the purpose of observing the action of this truck and noticed that considerable lateral motion took place in relation to the journal boxes and allied parts. I came to the conclusion that a minimum of ¾ in. lateral clearance should be provided in a journal box, or an equivalent in roller-bearing boxes,

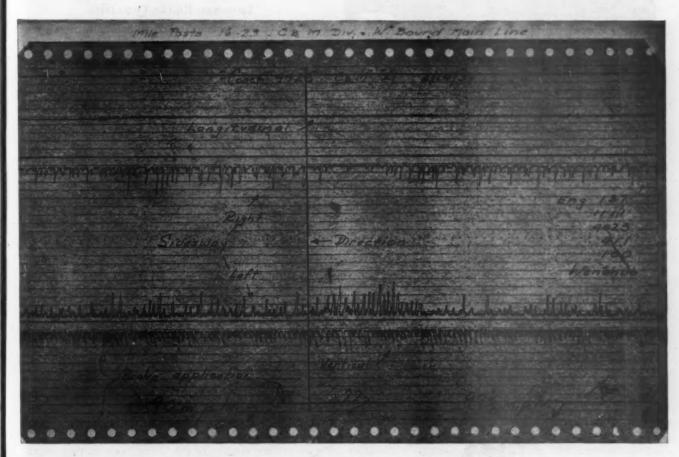
and proceeded to design a dual roller-bearing box or housing providing for lateral clearances and self-aligning features.

While making a trip to Europe, mainly to get some new ideas, I discovered, to my disappointment, that the Southern Railway of England had in successful service, a four-wheel passenger truck wherein every effort was made to avoid lateral clearance. Although the dual roller-bearing box is still in successful service, later roller-bearing applications have proven that lateral clearance is not essential as far as roller-bearing applications are concerned.

With this explanation, it will be understood that any conclusion arrived at in this paper should not be considered as final. The only thing we can claim is that we have definitely improved the vertical riding qualities of passenger-car trucks, as actual records will show. These charts were taken on a three-way ride recorder which shows vertical, longitudinal and lateral acceleration; the bottom curve represents vertical acceleration. It is calibrated so that each .1 in. on the chart is .1 gravity with .02 initial tension. We are not satisfied with our accomplishments as we know there is room for further improvement.

#### Numerous Tests Made

A large number of tests were made with various spring combinations and in 1936 a truck was designed somewhat similar to the European type. The bolster was supported solidly on a swing-hanger axis without springs. The swing hangers themselves were pin-connected to a spring-supported auxiliary bolster. The major portion of the springing of the truck was concentrated around the journal box. This type of construction later came to be known as a triple-bolster truck. The spring deflection had to be held



Ride recorder chart of a car equipped with four-wheel coil-spring trucks

en pab ed est er he of Id nuso low under the swing hangers to maintain car body stability that it was abandoned as a high-speed truck, although this truck is still in service under a suburban car.

When our own initiative failed, as far as adopting European truck practice was concerned, we obtained drawings



Truck used under Hiawatha cars in 1934

and duplicated a truck generally used in Europe, known as the Gurlitz truck, which differed from the truck just referred to in that the triple bolster feature was eliminated and a single bolster employed, supported by semi-elliptic springs suspended by hangers from two wheel pieces. Extensive tests were made with this truck but it did not possess sufficient merit to warrant its adoption for high-speed service; however, it is at the present time operating under a coach in our suburban service.

We continued our experiments, working on the premise



1938 truck equipped with equalizers and without springs over the journal boxes

that a truck having the springs applied over or immediately at the journal box would be more desirable from a cost and weight standpoint. We therefore made extensive tests with a non-equalized truck using a single nest of coil-springs over the journal box. This truck was designed so that if the non-equalized feature was unsatisfactory an equalizer could be applied. At this time in our test program, several novel features were introduced. First, the conventional elliptic bolster springs were replaced with large diameter coil springs, vertical shock absorbers were introduced and levellizing bars employed. This experimental truck possessed many desirable features but at speeds over 90 m.p.h. it produced considerable vertical oscillation and therefore was unsatisfactory.

The same truck, with the elimination of the helical springs over the journal boxes and the introduction of an equalizer with conventional equalizing springs, was employed under passenger cars built at Milwaukee shops in 1938. It has proved satisfactory with the exception that the conventional wear of roller-bearing boxes, equalizers, spring hangers, etc., still prevails.

In 1939, an inboard truck was developed, equipped with a rotor brake. The generator for air-conditioning and train lighting was suspended from the truck frame and driven by a pneumatic rubber tire held against the tread of the wheel. While this truck was desirable from a weight standpoint and had good lateral stability, due to the increased spread of the bolster springs, it also had some weaknesses. The brake, at that time, was not suf-

ficiently developed to justify its application; the rollerbearing arrangement was cumbersome and inaccessible, and most of the parts were not interchangeable with existing trucks. The generator drive, though interesting, was not very successful.

New coaches built in the year 1942 were equipped with trucks in which the conventional pedestals were eliminated and cast steel equalizers employed. The ends of the equalizers are formed to receive the roller-bearing boxes and the equalizer movement is spaced and controlled by rubber-cushioned guide members. This design eliminated all friction surfaces subject to wear, with the exception of the swing hangers.

#### **End Results Sought**

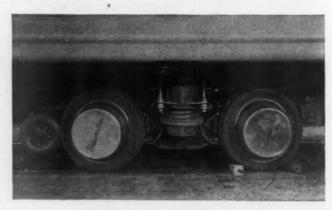
The foregoing is a brief outline of our search for an improved passenger truck design. Rather than go into a detailed description of each of the various trucks mentioned, the following is an outline of what we have endeavored to attain: (a) Safety, (b) improved riding qualities, (c) reduced weight, (d) lower noise level, and (e) elimination of friction surfaces.

#### SAFETY

In our developments and tests we have always set safety up as a first consideration and carefully observed the action of the trucks to detect any unusual behavior which would involve safety. We believe the truck developed for the 1942 cars is safer and more reliable than any truck we have heretofore produced because the equalizer also forms the pedestals and in a derailment the truck parts seem to hold together to a greater extent than in a conventional truck, helping to keep the car, with the aid of the center plate locking pin, on the right-of-way.

#### IMPROVED RIDING QUALITIES

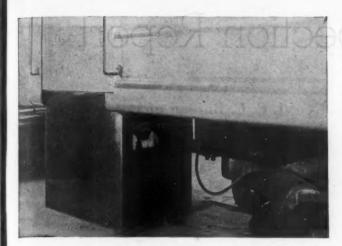
At the outset we endeavored to maintain the elliptical springs and improve the riding by increasing their deflection. As the ellipitical spring has a variable frictional resistance, depending upon the condition of the friction surfaces, and as this type of spring, under weather conditions we have to contend with, will often freeze into a solid block, we experimented with helical bolster springs. We



Inboard truck with rotor brake built in 1939

finally adopted one nest of helical springs at each end of the truck bolster, with a large outside diameter, in place of the elliptical springs. This new helical spring had a free height of 22½ in. and a solid height of 10½ in.

We also stubbornly insisted on absorbing the initial blows from the wheels by means of springs above or in the immediate vicinity of the journal box as that seemed to be the most logical and economical place for them.



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Observation booth installed in place of the vestibule steps in the test car

After making many futile attempts with helical, semielliptical and volute springs and rubber cushions, we had to fall back on an equalized truck and locate helical springs at a distance from the journal. In experimenting with a large number of springs at various locations and with varied deflections, it appears that there is not much wrong with the location of the springs in a conventional passenger truck if physical conditions permit applying helical springs of suitable characteristics.

Helical springs used as standard for freight cars have an oscillating frequency of 216 cycles per minute and pass through their first critical cycle at a speed of about 45 m.p.h. for fully-loaded cars. In the latest 1942 Milwaukee-built passenger cars, the springs have an oscillating frequency of 88 and 59 cycles per minute for the equalizer and bolster springs, respectively. The truck goes through its last critical cycle, that we have been able to observe, at 26 m.p.h., which is far below the operating speed. We have been unable to discover any additional critical cycle above 26 m.p.h., although we have reached speeds up to 126 m.p.h. We do not know if we selected the best combination of springs but we do know that so far we have improved the riding in almost a direct ratio to the lowering of the oscillating frequencies of the springs. With soft springs, shock absorbers and levellizing bars are necessities.

#### REDUCED WEIGHT

The weights of four-wheel experimental trucks, without generators, varied from 12,870 lb. to 18,723 lb. With careful redesigning and the use of high-tensile steel and the liberal use of aluminum, we estimate that trucks can be built to weigh approximately 13,000 lb. or 26,000 lb. per car set.

#### LOWER NOISE LEVEL

We have aimed to reduce the noise level inside the car and anyone who has tried to discover the source of noise will appreciate that this is a difficult problem. Assuming that most of the noise originates from the truck, we have probably taken some unusual precautions, and in so doing have obtained unusual and unexpected results. One of our first attempts, which we considered one of the vulnerable connections for transmitting noise from the truck to the car body, was the center plates. We, therefore, laid a 1-in. thick rubber cushion, bonded to a  $^{3}\!\!/_{6}$ -in. steel plate, in the truck bolster center plate; in addition, the periphery of the center plates was insulated with  $^{3}\!\!/_{8}$ -in. rubber which was bonded to sectional steel plates.

This arrangement was applied for test purposes in the

year 1938 to a dormitory car in Chicago-to-Seattle service, and one of our engineers, at the time of the application, wrote his initials and the date in yellow chalk on the face of the steel plate. After this car had been in service 19 months, the engineer's initials were still legible, which proved that instead of the usual rotational movement between the steel surface, the 1-in. thick rubber had sufficient rotating flexibility to take ordinary curves. The car in question had been in the above mentioned service operating through the mountains where there are many 10deg. curves. By freely employing rubber insulation between truck parts, metallic contact creating noise has been reduced. Continuing our search, we discovered that, although we had to the best of our ability insulated the truck from the car body, there is a fertile field for study of sources and transmission of air-borne noises to the inside of the car through tubular vertical end door posts in the frame of the body and the vestibule itself, which is outside the scope of this paper.

#### ELIMINATION OF FRICTION SURFACES

Friction creates wear and consumes power and both add to the expense of maintaining passenger-car trucks; its elimination means increased life and less adjustment of parts. By introducing the rubber between the truck and body center plate, as previously mentioned, all wear on those members was eliminated and we know that the life of the rubber is more than six years, having had some in service for that length of time. We have, by means of rubber-mounted guide members, eliminated the customary wear in bolsters, boxes and pedestals.

The swing hanger and swing-hanger pins are subject to severe wear and from experiments now being carried on, it appears that we can dispense with the swing hangers entirely and allow the large bolster spring to take care of the lateral motion between truck bolster and truck frame. At this time it seems wear of truck parts can be confined to wheels, roller bearings and brake parts. The life of the other parts would depend on the fatigue or durability of the materials employed.

In conclusion, acknowledgment is given to the General Steel Castings Corporation who have cooperated with us and have designed and furnished all cast steel parts used in several truck designs. Their engineers have also been of valuable assistance to us and have participated as observers in most of the road tests. The engineers of the Railway Steel Spring Division of the American Locomotive Company, the Monroe Auto Equipment Company and the United States Rubber Company have also given us valuable assistance.



The Chesapeake & Ohio car shop at Russell, Ky.

# Locomotive Inspection Report

THE effect of wartime traffic loads on railroad motive power is again evident in the report of the Bureau of Locomotive Inspection for the year ended June 30, 1944, issued by John M. Hall, director. The number of accidents and the injuries resulting therefrom showed a decided increase although deaths as a result of such accidents decreased.

The Bureau's inspectors found defects on 11 per cent of the 117,334 locomotives inspected, and of these or-

dered 630 out of service.

In addition to the tabular data included in this abstract the report included a detailed analysis of defects in relation to the parts of a locomotive as well as by railroad. Summaries of accidents reported by road and arranged chronologically for the period, are also included in the report. The abstract follows:

#### Violent Explosions

All of the 19 explosions that occurred in the fiscal year, in which 12 persons were killed and 62 injured, were caused by overheating the crown sheets, due to low water. Five of these explosions, in which, with one exception, the boilers were torn from the running gears or frames,

were particularly violent.

One of these accidents occurred while the locomotive was hauling a passenger train at an estimated speed of The boiler was hurled about 700 ft. forward from the point of explosion; it turned over in flight and alighted on the track ahead of the train, then bounded and came to rest 900 ft. from the point of explosion, and 35 ft. south of the track. All wheels of the locomotive and tender, the first 10 cars, and the front truck of the eleventh car were derailed. The fifth and sixth cars came to rest in V-shape across the tracks, and the running gear and tender came to rest 1,300 ft. from the point of explosion. The firebox crown sheet with upper part of the door sheet and parts of both side sheets attached alighted, turned inside out, 400 ft. forward and 100 ft. to the right of the point of explosion. employees were killed and 9 mail clerks, 5 Pullman porters, and 15 dining-car employees were seriously injured.

Table I-Reports, Inspections and Defects Found

STEAM LOCOMOTIVES Year ended June 30-Number of locomo-tives for which reports were filed Number inspected... Number found de-45,965 105,606 44,274 102,164 116,647 fective 11,901 10.970 9.570 8.565 9,099 12,710 Percentage inspected found defective Number ordered out of service Number of defects found 11 10 10 9 8 9 630 487 474 560 487 468 56,617 51,350 44,928 37.691 32,677 33,490 LOCOMOTIVES OTHER THAN STEAM Year ended June 30-1942 1941 1943 1940 1939 Number of locomotive units for which reports were filed
Number inspected
Number found defective
Percentage in spected
found defective
Number ordered out of 4.4 5 6 6

849

1,026

I. C. C. Bureau of Locomotive Inspection report again shows increase in defective locomotives; accidents and injuries also show increase

In another explosion, which occurred while the locomotive was hauling a troop train at an estimated speed of 50 m.p.h., one employee was fatally injured and died approximately 30 hours after the accident, and two employees were seriously injured. The boiler was torn from the frame fastening but remained attached to the cylinders; the main frames were broken off at the rear of the cylinders, all wheels were derailed, and the boiler and running gear came to rest at the base of an embankment approximately 249 ft. west of the point of explo-The first eight cars of the train were derailed. The first car of the train, an express car, was derailed to the right at a 45 deg. angle to the track, the second car, a standard Pullman, was derailed to the left and stopped practically parallel to the track ahead of all other wreck-The third car, a tourist Pullman, came to rest on top of the express car which was demolished. fourth car was derailed to the right at a 45 deg. angle, the fifth car leaned on the track fill parallel to the track, and the three following cars remained in upright positions.

Three employees were killed in another explosion which occurred while the locomotive was hauling a freight train at an estimated speed of 30 m.p.h.; the boiler alighted 340 ft. forward of the point of explosion with the rear end fouling the track; it was struck by the run-

ning gear which was then derailed.

In another accident where the boiler was torn from the running gear, in which one employee was killed and two employees injured, the locomotive, which had been hauling a freight train, was standing at a water tank. In its flight, the boiler destroyed the approach span of an overhead concrete highway bridge and came to rest on the slope of an embankment, 116 ft. from the point of explosion

Two employees were seriously injured in another accident caused by explosion of the boiler of a locomotive which was hauling a freight train at an estimated speed of 15 m.p.h. This boiler was not torn from the running gear or frame but the force of the explosion lifted the back end of the locomotive and caused it to derail and overturn on its left side crosswise of the north-bound and south-bound tracks. Parts of the wreckage were found scattered over a radius of 500 ft.

Five employees were killed and 26 seriously injured

in the remaining 14 accidents.

Occurrence of explosions caused by overheating of crown sheets due to low water, with consequent loss of life and serious injuries and damage to locomotives, clearly points to the hazard brought about by any relaxation of the vigilance normally exercised in the maintenance of safe water level or in the promptness with which the fire is extinguished in the event a safe water level cannot be maintained. All employees whose duties in-

service ..... Number of defects found

Table II—Accidents and Casualties Caused by the Failure of
Parts or Appurtenances
Steam Locomotive, Including Boller and Tender

	Year ended June 30-						
Number of accidents Number of persons killed Number of persons injured	1944	1943	1942	1941	1940	1939	
	402	319	222	153	164	152	
	25	27	34	15	18	15	
	466	373	227	182	225	164	

	STEAM .	Locomo	30	1			
		1944	1943	1942	1941	1915	1912
	accidents	141	129	81	43	424	856
	persons killed	17	25 173	30 83	12 64	13 467	1.005

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LOCOMOTIVES OTHER 1		Year ended June 30—				
Number of accidents	17		1942	1941 11	1940	
Number of persons killed	23	18	9	11	7	

clude responsibility for the maintenance of safe water level should see that water glasses, including water-glass cocks and all connections are properly blown out and gage cocks tested, and that all are known to be in good work-The water level shown in ing order before each trip. the water glasses should be closely observed at all times, and the glasses should be blown out sufficiently often during each trip and movement of the water in the glasses carefully noted at that time and thereafter to insure that the level in the glass moves up and down freely with the water level in the boiler which is subject to practically constant motion over a narrow range when the locomotive is working. It should be specially stressed that those observing the water level should always be guided by the lowest indication of any of the water-level indicating devices if there is any variation in the indications; in other words, the least favorable indication should be considered as the correct indication. Gage cocks should be tried frequently to check the level shown in the water If the water is below the line of sight in the water glass, emergency measures to protect the crown sheet from overheating should be taken at once; inter-pretation of a "flutter" of water from the bottom gauge cock as indicating safe water level in the boiler will in all probability result in disaster.

One thousand four hundred and four applications were filed for extensions of time for removal of flues, as provided in Rule 10. Investigations disclosed that in 46 of these cases the condition of the locomotives was such that extensions could not properly be granted. Sixteen were in such condition that the full extensions requested could not be authorized, but extensions for shorter periods of time were allowed. Fifty-nine extensions were granted after defects disclosed by our investigations were required to be repaired. Forty applications were canceled for various reasons. One thousand two hundred and forty-three applications were granted for the full period requested.

#### Mechanical Stokers

The Commission's Order No. 24049, dated March 18, 1939, established Rule 118 (c), the first paragraph of which requires that all coal-burning steam locomotives which weigh on driving wheels 160,000 lb. or more to be used in fast or heavy passenger service and all coal-burning steam locomotives which weigh on driving wheels 175,000 lb. or more to be used in fast or heavy freight service, built on or after April 15, 1939, be equipped with a suitable type of mechanical stoker and that such stokers be properly maintained.

The second paragraph of the rule required the filing by each railroad which operated coal-burning locomo-

tives of the above weights, with the Director of the Bureau of Locomotive Inspection, lists as of April 15, 1939, of all hand-fired locomotives of the specified weights built prior to April 15, 1939, which would in the future be used in fast or heavy service, that mechanical stokers be applied in each 12-month period to not less than 20 per cent of the total number so listed, that all locomotives included in the lists be so equipped before April 15, 1944, and that such stokers be properly maintained.

The number of hand-fired locomotives built prior to April 15, 1939, reported by the railroads as of that date to be used in the future in services requiring the use of stoker-equipped locomotives was 2,171. The lists filed by the railroads were revised from time to time as traffic increased due to our preparedness efforts and our participation in the war, it being necessary to use in fast or heavy service all locomotives that could be made capable of such use because of inability to obtain a sufficient number of new and more modern locomotives satisfactorily to handle the greatly increased traffic.

These revisions in the lists, after adjustments due to conversion of some of the locomotives to oil burners, replacements with new stoker-equipped locomotives, assignments to other than fast or heavy service, and retirements, resulted in the application of stokers to 3,648 locomotives before expiration of the time limit on April 15, 1944. This number of locomotives upon which stokers were applied is 1,477 in excess of the number originally reported by the railroads required to be so equipped. Various extensions of time for equipment of 245 locomotives with stokers, all of which expired on or before December 31, 1944, were granted by the Commission pending shopping of the locomotives involved for classified repairs. Stoker applications to these locomotives are proceeding currently.

#### Man-power Saving

The equipment of these locomotives with mechanical stokers contributed materially to the ability of the railroads to handle war-time traffic successfully. The boilers of these locomotives are, in general, of such capacity that maximum power of the locomotives cannot be maintained over any considerable period of time by hand firing without hazard of physical exhaustion of the firemen. The installations of mechanical stokers resulted in making available the maximum power of the locomotives when needed and for long sustained periods of time, thus increasing their usefulness and ability in the movement of present-day traffic which is heavier, and for the most part, is moved with greater expedition than was ever heretofore thought possible.

A further assistance in our war effort brought about by the application of mechanical stokers to these locomotives is the saving in man-power and labor turnover, and reduction in lost working time, or absenteeism, of the firemen. The hand firing of these locomotives was an arduous task before present-day traffic conditions obtained and often resulted in the necessity for longer rest periods than are generally considered normal for persons engaged in that service; this condition would have been greatly accentuated, and many employees now regularly employed in the firing of stoker-equipped locomotives would have been compelled, for reasons of health, to leave that occupation if mechanical stokers had not been substituted for hand firing.

During the year 4.9 per cent of the locomotives inspected by our inspectors were found with defects or errors in inspection that should have been corrected before the locomotives were put into use; this represents an increase of 0.5 per cent compared with the results

Table III—Number of Steam Locomotives Reported, Inspected, Found Defective, and Ordered from Service

Parts defective, inopera-	Parts defective, inopera- Year ended June 30-						
tive or missing, or in violation of rules	1944	1943	1942	1941	1940	1939	
violation of rules Air compressors Arch tubes Ashpans and mechanism Axles Blow-off cocks Boiler checks Boiler shell Brake equipment Cabs, cab windows, and curtains Cab aprons and decks Cab cards Coupling and uncoupling devices	1,146	968	829	684	567	518	
Ashpans and mechanism.	93	71	80	67	37	67	
Axles	289	291	238	205	191	204	
Boiler checks	533	503	393	313	288	279	
Brake equipment	2.914	2.661	2.382	1.945	1.506	1 577	
Cabs, cab windows, and	1.100	1 100	1.163	1,000	1,000	2,077	
Cab aprons and decks	381	390	335	307	277	260	
Cab cards	104	142	131	97	101	92	
devices Crossheads, guides, pistons, and piston rods Crown bolts Cylinders, saddles, and	65	66	70	74	53	60	
tons, and piston rods.	2,149	1.961	1,273	858	815	739	
Crown bolts	105	66	75	97	54	47	
Cylinders, saddles, and steam chests Cylinder cocks and rigging Domes and dome caps Draft gear Draw gear Driving boxes, shoes, wedges, pedestals, and braces	2,133	1,395	1,51%	1,332	1,320	1,232	
Cylinder cocks and rigging Domes and dome caps	624 189	430 196	521	438	447	418	
Draft gear	576	599	651	620	508	450	
Driving boxes, shoes,	515	469	369	347	306	360	
wedges, pedestals, and	2 026	2.052	1 742	1 240	1 242	1 220	
Firebox sheets	347	303	255	224	191	238	
Frames, tail pieces, and	274	215	178	150	147	165	
braces, locomotive	1,019	894	869	863	665	708	
wedges, pedestais, and braces Firebox sheets Flues Frames, tail pieces, and braces, locomotive Frames, tender Gages and gage fittings,	126	86	86	83	78	71	
Gages and gage fittings,	158	191	193	183	132	155	
steam	328	316 584	263	236	211	226	
Gage cocks	532	584	497	373	400	361	
Grate shakers and fire doors Handholds Injectors, inoperative Injectors and connections	539	492	491	430	273	252	
Injectors, inoperative	46	66	47	39	30	26	
Inspections and tests not made as required	9,565	9,037	8,186	7,215	6,218	6,645	
Lights, cab and classifi-	898	700	498	357	313	243	
cation	243	184	131	50	49	50	
Lubricators and shields.	257	292	234	196	185	200	
Mud rings	301	256	244	187	213	248	
Packing, piston rod and	240	003	002	500	410	400	
Pilots and pilot beams	193	724 194	738 188	675 142	660 140	739 104	
Plugs and studs	281	259	173	156	156	179	
made as required Lateral motion Lights, cab and classifi- cation Lights, beadlight Lubricators and shields Mud rings Packing nuts Packing, piston rod and valve stem Pilots and pilot beams Pilugs and studs Reversing gear Rods, main and side, crank pins, and collars Safety valves Sanders Springs and spring rig	434	934	411	38/	320	31/	
crank pins, and collars	3,230	2,798	1,986	1,565	1,199	1,293	
Sanders	609	642	738	490	415	432	
Springs and spring rig	4,625	3,583	3,349	2,597	2,174	2,340	
Squirt hose	94	92	67	62	50	75	
Stay bolts, broken	232	247	274	198	271	258	
Steam pipes	9 435 161	159	290 150	385	255	285	
Steps	872	729	594	555	449	490	
Sanders Springs and spring rig ging Squirt hose Stay bolts Stay bolts, broken Steam pipes Steam valves Steps Tanks and tank valves Telltale holes Throttle and throttle rig-	1,400	78	79	952 59	768 95	837 58	
	948	887	786	688	647	638	
Trucks, engine and trail-				-		-	
Trucks, tender	1,155 928	1,020	833 786	636 773	598 705	628 665	
Valve motion	1,021	998	779	580	506	554	
Wash-out plugs Train-control equipment.	845	685	569	445	478	487	
Water glasses, fittings,			1,133				
and shields	1,323 759	1,454 728	664	788 536	753 554	690 466	
Miscellaneous-Signal an-							
pliances, badge plates, brakes (hand) Total number of de-	1,167	1,142	970	785	564	610	
Total number of de-	56.617	51.350	44.928	37,691	32.677	33.490	
Locomotives reported Locomotives inspected	43,297	51,350 43,064 116,647 11,901	42,951	43,236	44,274	45,965	
Locomotives defective	12,710	11,901	10,970	9,570	8,565	9,099	
Percentage of inspected	11	10	10	9	8	9	
found defective Locomotives ordered out							
of service	630	487	474	560	487	468	

obtained in the preceding year. Nine locomotives were ordered withheld from service by our inspectors because of the presence of defects that rendered the locomotives immediately unsafe; this represents an increase of three locomotives compared with the next preceding year.

Under Rule 54 of the Rules and Instructions for Inspection and Testing of Steam Locomotives, 583 specification cards and 5,996 alteration reports were filed, checked and analyzed. These reports are necessary in order to determine whether or not the boilers represented

were so constructed or repaired as to render safe and proper service and whether the stresses were within the allowed limits. Corrective measures were taken with respect to numerous discrepancies found.

Under Rule 328 and 329 of the Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam, 793 specifications and 28 alteration reports were filed for locomotive units and 117 specifications and 100 alteration reports were filed for boilers mounted on locomotives other than steam. These were checked and analyzed and corrective measures taken with respect to discrepancies found.

One formal appeal from a decision of an inspector, as provided in Section 6 of the law, was made during the year. Subsequent investigation resulted in the decision of the inspector being sustained.

This appeal was based on an order to withhold a locomotive from service which our inspector found in use with a crack in the hub of a main driving wheel. An earlier transverse crack had developed in the outer circumference of the hub between an intermediate and a

Table IV—Number of Locomotives Other Than Steam Reported, Inspected, Found Defective and Ordered from Service

Parts defective, inopera- tive or missing, or in	Year ended June 30—						
violation of rules	1944	1943	1942	1941	1940	1939	
Air compressors  Axles, truck and driving	7	7	13	22	8	14	
Batteries	i	6 2	i	6	i	1	
Boilers Brake equipment		1	5 "	4	10	6	
Cabe and cab windows	85	62 33	86 27	69	50 22	50	
Cabs and cab windows	21	17	20	45 24	13	36 18	
Cab cards							
ucca plates	54	31	10	14	17	13	
Clutches Controllers, relays, circuit		-				* *	
breakers, magnet valves, and switch groups							
valves, and switch	14	9	12	7	16	13	
Coupling and uncoupling					20		
devices	3	1	5	2	6	4	
Current collecting apparatus		1	1	3	1	5	
Draft gear Draw gear	14	15	19	15	31	17	
Draw gear	**	2	3	3	2	4	
Driving boxes, shoes, and wedges Frames or frame braces.	12	25	16	36	29	52	
Frames or frame braces.	12	7	. 5	1	12	9	
Fuel system	33	32	81	62	51	35	
Gages or fittings, steam	2	1			2		
Gears and pinions	1	4	14	2	1	2	
Inspections and tests not	6	19	14	. 12	6	8	
made as required	278	223	274	243	207	185	
Insulation and safety de- vices	8		3	4	2		
Internal-combustion en-	0	4	9	-	-	4	
gine defects, parts and							
appurtenances	86	50	62	54	35	32	
Jack shafts Jumpers and cable connectors Lateral motion, wheels Lights, cab and classifi-							
nectors	9	10	1		5	1	
Lights, cab and classifi-	,	10		4	9		
cation Lights, headlight Meters, volt and ampere Motors and generators Pilots and pilot beams Ouilla	1	1	- 5	2	1	3	
Meters volt and amnere	2 2	2 3	1 2	1	3 4	4 2	
Motors and generators	14	14	16	16	12	19	
Pilots and pilot beams	2	4	10	12	10	5 7	
Quills Rods, main, side, and	18	9	6		4	7	
drive sharts	10	5.5	. 2	- 4	2	2	
Sanders Springs and spring rig-	59	41	57	56	34	- 28	
ging, driving and truck	44	18	35	58	50	16	
Steam pipes	3	1		.1	4		
Switches, hand-operated,	25	25	21	35	22	18	
and fuses Transformers, resistors,	2	2	2	2	3	5	
Transformers, resistors, and rheostats		3	3	3	1	1	
Trucks	47	22	28	30	43	33	
Water tanks	1	4	1	1		1	
Water glasses, fittings, and shields	4	2		1	1	1	
Warning signal appliances	2	3	3	4		1	
Wheels	74	107	43	28	22	16	
Miscellaneous	13	16	14	8	15	10	
fects	1,026	849	926	905	766	696	
Locomotive units reported	5,139	4,351	3,957	3,389	2,987	2,716	
Locomotive units inspected Locomotive units defec-	7,711	6,847	6,728	5,558	4,974	4,581	
tive Percentage inspected	378	298	358	319	298	260	
Percentage in spected found defective	4.9	4.4	5	6	6	6	
Locomotive units ordered		-	1 6				
out of service	9	6	12	21	16	14	

short-length spoke, and fusion welding had been applied in an attempt to repair this crack. Our inspector found a crack at the edge of this welding which crack had extended to the outer face of the hub and into the hub 4 in. toward the axle fit. When reexamined following the appeal, the presence of the crack was clearly evident without visual aid. It was stated in the appeal that a Magnaflux test of the wheel center had been made and that no crack was indicated by that test; after our reexamination the railroad officer who made the appeal advised that he had been misinformed as to the application of the Magnaflux test.

#### Recommendations

In accordance with the provisions of Section 7 of the Locomotive Inspection Act, the following recommendations, with reasons therefor, are made for the betterment of the service:

1—All steam locomotives should be equipped with a brake-pipe valve, similar to the conductor's valve used in passenger train cars and caboose cars, at the rear of the cab or the front end of the tender to enable the brakes to be applied in the event the enginemen are, from any cause, prevented from applying the brakes in the usual

Numerous accidents have occurred where, due to sudden failure of steam pipes or other causes, the cabs were immediately filled with steam and the occupants were forced out of the cabs without opportunity to close the throttle or to apply the brakes in the usual manner. Practically the only way that a train can be stopped in instances of this kind is for the engineman or fireman to climb out of or over the cab and make way to the front end and open the front-end brake-pipe angle cock if it is accessible.

2—All road steam locomotives should be equipped with means whereby the height or quantity of water in the tender feed-water tank may be ascertained from the cab or tender deck of the locomotive.

In the interest of expeditious movement of trains it often becomes necessary while proceeding on the line of road for the locomotive crew to have knowledge of the height or quantity of water remaining in the tender tank. The common practice in these instances is for the fireman to make his way back over the tender coal space, or fuel oil tank, to the filling hole on the rear of tender, open the cover of the filling hole, and measure the water height by whatever means that may be available. While performing this service, many slips and falls resulting in serious injuries have occurred due to the swaying of the tender while the train is in rapid motion, and weather conditions which render it difficult to maintain safe footing. The results of accidents of the nature herein described are not recorded in the accident statistics of the Bureau of Locomotive Inspection unless due primarily to some defective condition of the locomotive; however, the unnecessary hazard in proceeding over the tender to the filling hole to measure the water in the tender while the train is in motion at normal speeds is apparent.

The first recommendation was made in a previous annual report. Some of the railroads have recognized the value of the additional air-brake valve and have applied such a valve to a limited number of their locomotives. Likewise, some of the railroads have recognized the value of means to ascertain the quantity of water in the feedwater tank from the cab or tender deck. However, compliance with recommendations 1 and 2 is by no means generally widespread, and installations are not progressing to the extent that could be desired to obtain the

maximum degree of safety.



In this low-water explosion the boiler was thrown 116 ft.-One employee was killed and two seriously injured

#### **EDITORIALS**

#### Hot Boxes a Perennial Problem

It is practically impossible to eliminate hot boxes in railway equipment, especially freight cars, but, admitting freely the present handicaps of severe winter weather in many parts of the country, difficulty in retaining an adequate force of experienced car men, lack of suitable packing materials, etc., much more can and should be done to keep the number of hot boxes down to a point where they will have a substantially less adverse effect on railway operation. Hot boxes cannot be eliminated, but they can be minimized.

No longer ago than last October, the A.A.R. Mechanical Division, anticipating what probably lay in store in the way of equipment delays due to the development of hot boxes under adverse winter conditions, made a study of journal-box inspection and lubrication practices then being followed by railroads and private car lines and found them deficient in many particulars. Some of the more predominant irregularities included the following: Packing in storage not properly saturated; improper waste reclamation; excess amount of free oil used during periodic attention; interior of journal boxes not properly cleaned prior to repacking; improper reclamation of journal bearings, resulting in loose lining and other irregularities; missing or defective dust-guard plugs not renewed during periodic attention or when wheels are exchanged; loading of cars where journal boxes are overdue for periodic attention; improper storage of journal bearings, resulting in injury to bearing surface; use of packing irons with too short blades; flat condition of wedges not determined during periodic inspection; missing, loosely fitting or otherwise defective journal-box lids; journal bearings worn out; packing too high, or contaminated with water, dirt, sand, gravel, wood, rags, rust and other foreign matter; packing dry, not evenly distributed, rolled and up against the journal bearings or worked forward and up against the journal-box lids; waste grabs under journal bearings on cars lined up in trains O.K.'d and ready for departure.

The A.A.R. issued a circular letter calling attention to these unsatisfactory conditions and irregularities and suggesting that each railroad and private car owner investigate practices at its own shops and repair tracks and take action to assure compliance with present approved rules instead of waiting for an official investigation and report by the A.A.R. Mechanical Inspection Department. The record of hot boxes developing in recent months proves that less than the desired amount of work has been done along this line in raising journal-box inspection, lubrication and maintenance standards.

Hot boxes in passenger car service have constituted a real problem on many roads this winter. With excessively low temperatures, it is impossible for coach yard forces to function with their usual efficiency in inspecting and servicing journals. Cold journals, in starting, frequently cause the packing to roll up and work under the brasses. And perhaps worst of all, snow and moisture get into the journal boxes through poorly-fitting covers and dust-guards, freezing and breaking down the lubricating properties of the packing. There is only one solution to this problem and that is to get busy, in spite of all handicaps, and inspect all journal boxes on incoming trains, repacking those which show evidence of moisture or other undesirable conditions, applying a small amount of cut-back oil where necessary to prevent waste from rolling and checking all boxes again before trains leave.

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At one large passenger terminal in Chicago where these practices were put into effect in December, the number of journal boxes repacked jumped to 750 a day and several hundred journal-box covers a day were refitted and applied in an effort to keep out snow and water. This was a really big and tough job, under the conditions, for the car department force involved, but the gratifying result, was a reduction in passenger-car hot boxes on that road from 7 or 8 a day to about one a day or less. In spite of strenuous efforts, it seemed impossible to cut out that last hot box, which simply bears out the statement earlier in this editorial that hot boxes can be minimized but hardly eliminated.

#### **Jack-Handle Days**

According to the best estimates of time-study men on one of our major railroad systems, two 50-ton air-operated jacks installed at an average freight-car repair point today will have paid for themselves by savings in labor costs alone within 15 months. Even more important are the man-hours saved for use on other work and the increased speed of car release from repair points. Experience has shown that about 800 hours of mechanics' or helpers' time has been saved through such an installation during the course of a single year. At an exceptionally busy shop point such an installation, made in 1937, was paid for within the first four months after the jacks were delivered.

Various committees of the Car Department Officers' Association and other groups have urged consistently that more attention be paid in the expenditure of mechanical department funds to the needs of car repair points. Whether the men on the locomotive side have been more articulate in expressing their needs isn't clear but generally it appears that a new shaper for the backshop or a lathe for an enginehouse is more likely to be approved than two jacks for the car yard. Their relative cost is small, the rate of amortization on the

investment high but at all too many points the jack handle rather than the air-line lifts cars.

What is true of car jacks is true of many other items of equipment in use at car repair points. A thorough study on any system of the possibilities of employing modern tools and devices would enable car department officers to approach management intelligently with requests for appropriations. The accumulated labor cost and car-release delay time represented by jack-handle days should convince even a stubborn management in times much harder financially than the present.

#### Notes on Lighting

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In the course of developing the nation's industry for war, many huge war plants have been built which are spectacular for their size, the speed with which they have been placed in operation, the great number of people they employ, etc. Frequently they are equipped with lighting installations which in themselves are spectacular for the large areas lighted and for high values of lighting intensity. They make most railroad shops appear dingy by comparison, but they should not for this reason alone be held up as an example of what railroads should do. Any engineer can install a large number of fixtures and obtain high intensities if his cost accounting is not scrutinized too closely. To get an installation which meets the needs of a specific requirement at a justifiable cost requires real engineering.

More or less typical railroad lighting is usually farther from good practice than that in hastily constructed war plants. Railroad lighting stemmed originally from the smoky oil torch, which even now finds favor among many enginehouse workers. In one location portable extension cords were connected permanently in an enginehouse and instructions to use them issued from headquarters, but the oil torches would reappear as soon as the headquarters representative was Persistence in the use of oil torches may be partly tradition, but the fact that the practice continues so tenaciously suggests that some of the newer methods are not enough better to assure displacement of the Much experimenting is being done in this field and the use of fluorescent lamps offers considerable promise.

Among lighting engineers it is quite generally accepted that good lighting in a shop consists of uniform general illumination, supplemented at machine tools, benches, etc., by local lighting units which increase the intensity of the lighting on the work being done. Glare is of course to be avoided as are also any brightness contrasts in excess of ten to one; that is, the work should not reflect more than ten times as much light as the background.

Good general illumination in a machine shop may constitute bad lighting. Suppose for example, the illumination on the horizontal plane is 20 footcandles. It

may, however, be no more than ten on the vertical plane. Then when the operator, who is working on a vertical surface, stands up to his machine, his shadow may reduce it to two or three. If the reflection factor of the work is perhaps half that of the background, the operator is then looking toward a background that is twenty times as bright as the thing he is trying to see. Conversely, if only local lighting is used, the work may be so much brighter than the background that his eyes tire quickly.

Priorities on material have made it difficult for the railroads to do much about improving of lighting systems, and in many railroad locations, depreciation rates of such equipment are high. By the time the material situation becomes easier, the railroads will have much lighting replacement work to do and it is expected that they will take full advantage of available knowledge of what constitutes good lighting and also of the many new light sources, light controls and wiring materials which have been developed since the railroads have had full opportunity to make lighting installations.

#### Boiler Explosions — Must We Have Them?

During the year ended June 30, 1944, according to the report of the Bureau of Locomotive Inspection, I. C. C., there were 19 locomotive boiler explosions in which 12 persons were killed and 62 injured. All of these explosions were due to low water and overheated crown sheets. This is a record which the railroads have no reason to be proud of and in viewing these statistics it matters not so much whether there were fewer, or less, explosions than in some previous period, but that there were any at all. It may startle some people to make the blunt statement that there is no excuse for a boiler explosion but such is the case and in making such a statement we recognize that we are ignoring their basic cause—human carelessness and poor judgment.

In discussing boiler explosions one is faced with the necessity of repeating again and again arguments that have been used as long as there have been steam locomotive boilers so that it is not possible to present some new approach to the problem in the light of recent experience. These accidents, except for that one case in a million, are the result of man-failures and, in all fairness to the men who operate locomotives, it may be well to say right at the outset that such man failures are not always chargeable to the men in the cab.

We have had enough experience in the design and construction of locomotive boilers that it is reasonably safe to say that any boiler constructed in accordance with I. C. C. requirements is a safe boiler, if . . . (1) the safety and protective devices which have been installed on it are maintained, at all times, in an operative condition; (2) these devices are inspected both by engine-house inspectors, the engine handlers and the engine crews to make sure that they are functioning properly before a locomotive ever leaves a terminal and (3) the

water level indications are constantly checked by the engine crew and water supplied to the boiler to maintain a proper level in accordance with its requirements. These things having been done there is rarely ever an excuse for loss of life, an injury or the destruction of property as a result of a boiler explosion. Why, then, do we continue to have them?

There is one thing that the I. C. C. Bureau of Locomotive Inspection report does not show and that is the number of near-explosions, these unrecorded cases where the initiative, the good judgment and the quick action on the part of an engine crew have saved life and property by dumping a fire when it became evident that there was no chance of maintaining the proper water level in the boiler. Possibly these are the incidents about which greater publicity should be given, for behind them are the controlling factors that operate to prevent boiler accidents. If every railroad management could impress indelibly on the mind of every employee connected with locomotive boiler operation the simple fact that there are times and circumstances when there is only one thing to do-to dump the fire-we would see an immediate reduction of boiler accidents. Management must, however, carry on a constant campaign of education and discipline; education in the fact that safety of operation and the protection of life and property are always more important than the maintenance of a schedule; discipline in boiler maintenance, inspections and those details of watchfulness and functioning on the part of every employee whose job it is to watch the water level. And when that crucial moment comes when, through whatever cause, the water level cannot be maintained, management must also have made it clear that there need be no hesitation or concern about what some one will think-just dump the fire.

#### Present Wheel Shop Machinery Inadequate

Some modern machine tools and shop equipment have been installed in railway wheel shops in recent years, but not enough to have any great effect on the total machine inventory as regards its state of being to a large extent old, worn out and obsolete. Additional testimony to the accuracy of this statement was afforded at the December 11 meeting of the Car Foremen's Association of Chicago when the principal paper, "Wheels for Post-War Railroad Service" was presented by C. T. Ripley, chief engineer, Wrought Steel Wheel Industry, and the entire subject of wheel performance and maintenance was gone into quite thoroughly.

In introducing his subject, Mr. Ripley pointed out that the total annual cost for all types of locomotive, passenger and freight car wheels on one large railway system was \$2,110,000 and that this figure, if applied proportionately to the total car and locomotive ownership of all railroads, exclusive of cars of private ownership, would amount to approximately \$60,000,000 a year. This amount is a sizable percentage of the

total cost of equipment maintenance on American railroads and hence constitutes an item which should be constantly checked and rechecked from every angle of wheel purchase, use and maintenance, with a view to effecting maximum practicable economies. The statement was made during the course of the meeting, and not challenged, that improved wheel practices, particularly as regards maintenance, would make it feasible to reduce total wheel costs to the railroads at least 20 per cent or \$12,000,000 a year.

Here, then, is the incentive for a re-examination of railway wheel shop machinery and practices which need further substantial improvement in spite of all of the efforts already made along this line, both by individual railroads and the Association of American Railroads, Mechanical Division. Unsatisfactory conditions, all too commonly found, include out-of-round wheels, taper wheel seats, mismated wheels, poorly finished journals, etc. Some old axle lathes cannot machine either wheed seats or journals accurately. Boring mills sometimes cannot be kept in condition to bore wheels central regardless of constant checking. Mr. Ripley stated that on some of the older wheel lathes, wheels are turned as much as .04 in. eccentric and on the average wheel lathe .02 in. He advocated the use of modern grinding machines which can hold this eccentricity to .005 in., with resultant improved riding, less wheel sliding, less wear and breakage of truck parts and fewer hot boxes.

Not only should wheels be accurately round and concentric with the journals when applied under freight as well as passenger equipment, but this condition ought to be maintained in service, and modern wheel-grinding machines are an important aid in this desirable objective. It may also be said in favor of the grinders that they conserve a large amount of tread-wear metal by making it unnecessary to cut under work-hardened wheel treads, in order to hold a chip and avoid breaking wheel-lathe tools. Wheels with flat spots up to 2 in long, for example, can be reconditioned by grinding off just enough metal to give a true circular tread, whereas a wheel-lathe cut generally has to be at least 1/8 in. deeper.

Another machine which may in a short time receive consideration for installation in car wheel shops is a balancing machine for mounted passenger-car wheels. Such machines have already been developed and experiments are now being conducted, primarily to find a satisfactory method of correcting any conditions of static or dynamic unbalance which may be uncovered. It seems clear that for the high speeds of to-day and possible super speeds in the post-war period, passenger-car wheels may have to be balanced to assure the necessary smoothness and quietness of car operation.

In these days of arduous and high-pressure rail transportation, railroad men are confronted with many problems, not the least of which is the improvement of wheel performance, especially as influenced by wheelshop machinery and practices.

# With the Car Foremen and Inspectors

#### C. & N. W. Installs Portable Car Washer

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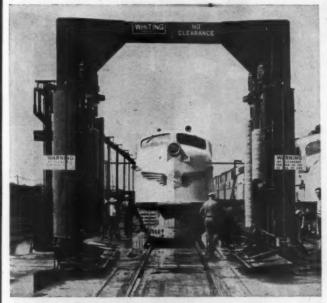
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The exterior cleaning of passenger train cars is an arduous job under the best of conditions and especially so at present, owing to difficulty in maintaining an adequate labor force. To meet the emergency presented by high car-cleansing costs, shortage of labor and the necessity of quick turn-around time for the large number of streamline trains operated into Chicago over the lines of the Chicago & North Western, this road has installed a portable car washing machine at its Diesel streamliner servicing yard which is producing unusually good results.

This machine, made by the Whiting Corporation, Harvey, Ill., is mounted on small wheels on a cross-track so that it can be easily rolled into position at any one of four active tracks for washing streamline coaches and Diesel locomotives as the trains are backed on to the servicing tracks. On the basis of experience with this car washer since it was installed last August, normally washing an average of four trains, or 60 cars, a day, including 12 Diesel-electric locomotive units, it is estimated that the machine will more than pay for itself in the first year of operation.

Referring to the illustrations, the general construction

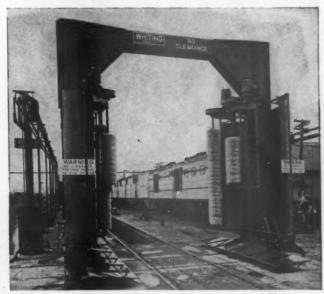


Whiting portable car washer positioned over one of four tracks at the C. & N. W. Diesel-train servicing yard, Chicago—One train has just backed through the washer

of the portable car washer will be apparent. It consists of two substantial vertical steel members, tied together at the top by a sturdy cross member, well braced with gussets. The bottom ends of the columns are equipped with four flanged wheels for movement across the servicing tracks by means of a hand racking mechanism. The machine is clamped and positioned by four adjustable clamps hooked to ground rings, and four liftable pins

engaging suitably located holes in the cross track. The machine is designed to be readily moved by one man and rigidly held when clamped.

This portable car washer, as installed on the North Western, is designed for one-way washing only, as all cars are washed while passing in one direction to the layover tracks. Each side of the washer carries one long 15-in. by 9-ft. brush which operates at a speed



The portable car washer ready for a streamliner to back through under its own power

of about 240 r.p.m. by V-belt drive from a 3-hp. electric motor and is used to wash a car side from the edge of the roof down to the bottom of the side sheets. A self-alining feature enables this brush to adjust its position to the tilt of the car bodies. The shorter 15-in. by 3-ft. 10-in. brush, also operates at 240 r.p.m., but driven by V-belt connection from a 2-hp. electric motor, is positioned so as to wash the windows which are practically flush with the car sides in modern streamline equipment. These brushes consist of fibres suitably secured to wood cores and applied in staggered half sections which are bolted together around a slotted drive shaft. The brushes are thus positively prevented from turning on the shafts and there are no uniform horizontal breaks or lines between individual brush sections to leave marks on the car sides.

There is one water-spray pipe back of each brush to keep it well soaked and, in addition, the entrance and exit end on each side of the car washer carries a full-length vertical water pipe with eleven ½-in. nozzles, evenly spaced about 10 in. apart and directed at right angles against the car side which thus receives a copious water bath both before and after passing the brushes. Drain pans and splash plates are applied to deflect the falling water into sewer openings located directly under the car washer.

Reference to the illustrations will show that the brushes

are mounted on swinging arms and may be held against the car sides at constant predetermined pressure by means of suitable counterweights. When not in use, the brushes are swung back out of the way of any cars which may be passing through. Brush arm movements to

The anchoring mechanism, hand-ratchet device, water and electric

"operative" and "inoperative" positions are controlled by a 30-in. hand lever located on the back of the structure at each side of the car washer. Water is supplied through a single 2-in. hose connection to the car washer and it is extremely important to have an adequate supply of water, preferably at a pressure of about 40 lb. Electric connections to the brush-operating motors are supplied, with push-button control from the same side of the machine to which water is supplied.

#### How the Portable Car Washer Is Used

After streamline trains arrive at the C. & N. W. passenger station and are unloaded, all vestibule doors are carefully closed and the same engine crew backs the train a short distance west to the Chicago shops where it is slowly pushed through the portable car washing machine, at a rate of about 80 ft. a min., and on to the servicing tracks where all other necessary work is done during the limited layover time. (When again ready for service, the train is backed on through the servicing yard to a large Y, headed west on the main line and backed into the Chicago passenger station for reloading.)

With adequate water pressure and volume and brushes revolving at the specified speed, cars passing through the washer will be cleaned at least as thoroughly as by hand and, of course, with much less manual labor. In North Western experience, it has been found desirable to hand wipe the windows afterwards in order to avoid streaks, and the front ends of the Diesel locomotives and the rear ends of the observation cars have to be hand cleaned. Car roofs are not washed, because drippings from the roof would run down after rinsing and have a tendency to streak the car sides. Another limitation

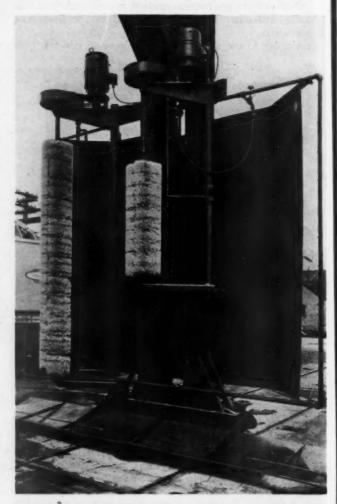
of any car washer operated out of doors is that it cannot be successfully used in freezing temperatures.

#### How Exceptionally Dirty Cars Are Cleaned

It is understood that the car washing operations described thus far comprise what is called "light cleaning" and utilize water, only, in the car washing machine. For those cars requiring "heavy cleaning," it is necessary to apply a light and preferably uniform spray of oxalic acid or some commercial cleaner, thoroughly distributed over the car sides and allowed just enough time to neutralize itself before being brushed and rinsed off in the car washing machine.

For this purpose, the North Western has constructed two vertical stand pipes each equipped with three  $\frac{5}{64}$ -in. spray nozzles and located on either side of the lead track about 100 ft. ahead of the car-washing machine at the servicing tracks.

The cleaning solution, mixed in one of the adjoining car shop buildings, is contained in two 80-gal. tanks mounted on wheels and supplied with air which forces the cleaner out of the standpipe nozzles in fan-like sprays covering the car sides from the top of the letter boards to the bottom edges of the skirt sheets. The North Western found that if cars are then moved down the track and through the car washing machine, the leading water spray will have the effect of washing off a considerable amount of the cleaning solution before it has a chance to be worked in by the brush. In washing cars, therefore, which require the use of a cleaning solution, the



The brush support and driving mechanism, spray pipes and drip pan

lead water sprays on the car washer are turned off; the brushes thoroughly rub the cleaner on the car sides; and

the final spray rinses the cleaner off.

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Several precautions need to be observed, aside from maintenance of proper brush speed, water pressure and volume. In the first place, the location of the cleaning solution sprays sufficiently in advance of the car washer is of fundamental importance, also assurance that the cleaner does not remain too long on the highly-finished car surfaces; car speed past the brushes must not be too fast and the North Western finds that one car a minute, or roughly 80 ft. a minute, is about right for the desired results; all sprays and brush action must be controlled so as to avoid getting water on the car roofs from which it will subsequently drop and streak the car sides; in the case of cars washed with the cleaning solution, all of this solution must be thoroughly scrubbed and rinsed from the car sides before they are allowed to dry, otherwise the exterior finish will be damaged.

To make doubly sure of the latter objective, it is proposed to increase the number of nozzles on the exit spray pipe in the present installation and direct them both ahead and back of the perpendicular so as to flush the car sides even more thoroughly than is now the case.

This portable car washer installation on the North Western is the first of its kind and hence somewhat experimental in character. On the basis of experience, minor changes and improvements may be expected. It has been recommended, for example, that consideration be given to installing an additional long brush on either side of the machine to assure a still more thorough cleaning job in less time; that an electric pump be installed, especially in cases where there is any tendency for the water pressure at delivery nozzles to drop below 40 lb.; that wheels of larger diameter be installed to facilitate moving the washer over the cross tracks; and that refillable metal brush cores be substituted for the present wooden ones in order to permit increasing the brush speed to 370 r.p.m. and avoid the warping and breakage tendency of wood-core brushes.

Savings effected with the present portable car washer are large, however, in spite of being based on the relatively light operation of washing an average of 60 cars a day. The capacity of the machine is much higher than this and hence it is adapted to make proportionately increased savings if and when additional service tracks are installed at the Chicago Diesel train yard and more cars are available for and require washing.

couplers at all interchange points and when cars are on repair tracks, everything possible being done to detect and correct defective condition of these parts to avoid failures in service.

#### C. & N. W. Tries New Journal-Box Cover Shield

One of the most serious problems confronting the railroads, particularly this winter as a result of heavy snow falls throughout the country, is combating hot boxes on passenger trains. It has been necessary to resort to unusual tactics, including the assignment of additional forces in coach yards for the repacking of journal boxes as the result of water-saturated packing. In order to reduce the entry of snow and road dirt in journal boxes,



The shield shown with the lid open

a journal-box cover shield has been devised, as shown in the illustrations, by G. R. Anderson, assistant super-intendent car department, Chicago & North Western, and is now being generally applied to passenger train cars on this road.

These shields, not patented, are made of No. 16 gage galvanized sheet steel, in two parts or sections, one right and one left, each being trimmed to size from a flat sheet, veed out at one corner and having two sides bent or flanged so as to bring the edges of the vee together where they are held by tack welding. Two shield sections are then applied by spot welding, one on each side of the journal box cover in such a way that one flange covers each side joint and the lips on the bottom of the shield cover the bottom joint.

In the main, this journal-box cover shield serves as a wind deflector to keep air current caused by high-speed

#### More Rigid Car Inspection Needed

In a circular letter, dated January 15, V. R. Hawthorne, executive vice-chairman of the A.A.R. Mechanical Division calls attention to reports being received of an increasing number of defective and broken truck side frames, particularly of the older types. Unless the defective conditions are detected in inspection and corrected, failures may occur enroute and result in derailments or wrecks. The older-type side frames must be maintained for the duration of the war emergency. Realizing this, the letter stresses the need for special efforts to inspect these frames, also defective bolsters, wheels, couplers, brake beams, etc., which constitute a definite hazard to operation. It is requested in the letter that all railroads and car owners take necessary action to insure a most rigid inspection of trucks, wheels and



Journal-box cover shield developed on the Chicago & North Western

operation from blowing directly at on into the joints between the cover and the journal box. The Chicago & North Western has found that, with these shields attached, the intake of snow and foreign matter at the front end of journal boxes has been greatly reduced which tends to prevent the development of hot boxes from this cause and makes it unnecessary to repack journal boxes as frequently as in the past when, under adverse winter conditions, 500 to 800 boxes had to be repacked every day at some large coach yards.

#### Air Brake Questions and Answers

HSC High-Speed Brake Equipment for Passenger Cars and A and B Diesel Locomotive Units\*

267-Q.—Describe further, the various parts of the independent brake valve and their functions. A .- The brake application is obtained by moving the handle to the right which increases the cam pressure on dog 72 and pusher 68. The balance levers are attached to pusher 68 with roller 69 pivoted on exhaust valve 65. The lower end of the balance lever pivots on inlet valve 50 through push rod 70. The balance levers control the self-lapping function of the brake valve, as later explained. The exhaust valve seat is located in piston 59 and is connected by a series of holes to the spring cavity which is open to the brake valve exhaust. The interior chamber of the brake valve is connected to the independent application and release pipe. This connection is controlled by the cam through the dog, to hold application valve unseated in all positions of the brake valve handle except locking position. The brake valve handle is hinged by a cam roller and is held upward by a spring. Independent release is obtained by depressing the brake valve handle on a ball which operates the release check volves. The lower spring normally holds the lower check valve seated, closing off the main reservoir supply, and the upper check valve unseated,

\* This is the continuation of a series, the last of which appeared in the August, 1944, issue.

opening the actuating pipe to the atmosphere. When the handle is depressed on the bail, the plunger seats the upper valve and opens the lower valve, permitting the main reservoir air to flow to the actuating pipe. The locking position consists of a slot in the handle guard at the extreme left. To place the handle in this position, depress the handle and move it to the left into the slot, which locks the handle down. The plunger seats the upper valve and unseats the lower valve, holding the brake released. Also in this position the handle cam raises the dog and seats the application valve, closing the independent application and release pipe. Controlled emergency valve is held seated by a spring in all handle positions except full application, in which position a cam on the handle shaft engages the valve stem and unseats the valve.

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268.—Q.—During initial charging, what must be done? A.—Either the MS-40 brake valve handle or the foot valve pedal must be held down.

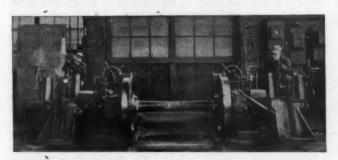
269-Q.-Describe the initial charging operation on locomotives. A .- With air compressors cut in and operating, air flows to the first main reservoir of each unit, thence through the connecting pipe and check valve to the second main reservoir. A branch from the reservoir connecting pipe is connected between units and thus equalizes the main reservoir pressure on both units. Air from the second main reservoir flows through the H filter to connection 6 of the FS-1864 or f-1864 relay valve and D-22-ER control valves on both units; on the A unit to connection 21 of the S-40-C independent brake valve and to the M-3-A feed valve and M-3A reducing valve; on the B unit to the SA-5 hostler brake valve. Reducing valve air at the pressure controlled by the adjustment of the reducing valve, flows through the reducing valve pipe and through the C-1-3-6 strainer and check valve to the signal pipe, charging this line to approximate reducing valve pipe pressure. On the A unit the feed valve reduces the main reservoir air to its setting of 110 lb. and feed valve air flows to connection 21 of the MS-40 brake valve, choke 115, past the non-return check valve 90 to chamber A above rotary valve 54, and through branch port 21a to the chamber of inlet valve in the self-lapping portion. With either the brake valve handle or foot valve pedal held down, the air flows through pipe 21 to the 21 connection of the M-2 brake application valve, charging chamber A back of the piston 4, and through choke K in the piston, charging chamber B on the face of the piston. From chamber B, the flow continues through passage 10b, cut-out cock 19 and passage 10a to pipe 10 and the diaphragm cut-off valve, lifting the lower diaphragm of the latter and flowing to the foot valve. With the foot pedal released, the flow continues through pipe 3 to the MS-40 brake valve, thence through passage 3 to the pilot valve 21 at the top of the brake valve. With the brake valve handle held down, the pilot valve is seated and the safety control system charged to feed valve pressure setting. The pressure thus equalizes on both faces of piston 4 of the M-2 brake application valve and spring 12 holds the piston and attached slide valve in release position. If the foot pedal is held down, the brake valve handle may be released and the safety control pipe is held charged up to the foot valve where the diaphragm is held sealed by pedal pressure, preventing the flow to the brake valve pilot valve exhaust. With the M-2 brake application valve in release position the reduction limiting reservoir is connected to the M-2 brake application valve exhaust through passage 24, choke N and ports Z and C in the slide valve to exhaust Ex. Feed valve air, at the pressure controlled by the

adjustment of the feed valve, flows through a pipe to connection 21 of the MS-41 brake valve, thence past a check valve to chamber A above the rotary valve. With the brake valve handle in release position, air from chamber A flows through port a in the rotary valve and pipe 2 to connection 2 of the M-2 brake application valve, thence through passage 2a to the chamber above the cut-off valve head, and through passage 2 to the slide valve. With the latter in release position, cavity V connects passages 2 and 2b so that feed valve air flows to the spring chamber beneath the cut-off valve piston. Air pressures below and above the cut-off valve piston, therefore, are equal and the spring holds the cut-off valve unseated, permitting the feed valve air to flow from passage 2a past the cut-off valve head to passage 1a, pipe connection 1 and pipe 1, through the double heading cock, thence to the brake pipe, charging it to feed valve pressure. In the M-2 brake application valve passage 1a also connects to chamber  $\hat{F}$  of the equalizing piston valve portion, charging it to brake pipe pressure. At the MS-40 brake valve, port b in the rotary valve connects the feed valve pressure from chamber A to pipe 4 and connection 4 of the M-2 brake application valve, thence through cavity in the slide valve to passages 5a and 5, thence to the equalizing reservoir and chamber D in front of the equalizing piston, and charging these to the same pressure as that of the brake pipe. As piston chambers F and D of the equalizing piston are charged equally, the piston is balanced and the spring holds the piston in charging position through lever 49, and maintains the discharge valve on its seat. Discharge valve passage 16 is connected to pipe 16 and to the rotary of the MS-40 brake valve, where it is blanked. Thus, if the brake pipe chamber F charges faster than the equalizing reservoir chamber D, causing the piston to move and open the discharge valve, no brake pipe air will be lost, and the pressures will equalize and close the discharge valve when the two pressures become equal. A branch from the brake pipe connects to the MS-40 brake valve connection 1, charging passages 1 and 1a and the spring chamber of emergency valve and its pilot valve, which are held seated by their springs.

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#### **Grinder Saves** Car-Wheel Metal

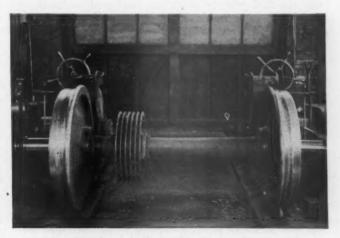
Since 1941 over 18,000 pairs of car wheels have been ground at the Western Avenue coach yard of the Chicago, Milwaukee, St. Paul & Pacific at Chicago. The practice is to grind all car wheels after they are turned. In order to conserve service wear metal, tread-wornhollow wheels are put in the wheel lathe, the flanges



Floor-type car wheel-grinding machine installed at the Western avenue, Chicago, car wheel shop of the C. M. St. P. & P.—Roller bearing wheels shown in the machine

cut down to the proper contour and height and the outer edge of the tread turned down, leaving the original wearing surface at the center. These wheels are then put in the grinding machine and the tread surface ground only just enough to true the wheels. It is estimated that at least 1/8 in. of wear metal per wheel is saved by this operation as compared with turning the entire wheel contour in the wheel lathe. In the case of the wheels having sharp flanges, full contour turning in the wheel lathe is of course essential.

A record of car wheels handled at the Western Avenue car-wheel shop shows that during 1944, 1,519 pairs of car wheels were turned, 1,656 pairs partially turned by the process just described and 4,567 pairs ground. The latter figure included all wheels turned plus those ground to remove flat spots. About 1/64 in. of metal is removed for each pass of the grinding wheel which is



Car wheel grinder and a pair of tread-worn-hollow wheels which have had the flanges re-formed and the outer rim cut down, leaving original metal in the tread to be trued by grinding

set on a taper to correspond with that of the tread. Two or three passes of the grinding wheel across the tread are usually required to remove a 2-in, flat spot.

Unless there is a change in wheel size, practically no set-up time is required in rolling a pair of car wheels into the American Car and Foundry car wheel grinder and mounting it between the centers. In the case of wheels with ball-bearing journals, however, the front cover of the journal box on each side has to be removed and a wood block inserted to cover the bearing and protect it against abrasive particles. This wood block leaves the end of the journal uncovered and the axle center hole can be readily lined up for insertion of the ball-bearing dead center on each side of the grinding machine. Two operators are used on the machine which normally grinds from 14 to 16 pairs of wheels in eight hours. This is an average of somewhat more than 30 min. per pair of wheels, a production which cannot usually be maintained when there are many wheels with 2-in. flat spots.

The grinding wheels used on this machine are 21/4-in. wide by 30 in. in outside diameter and mounted on 12-in. mandrels which operate at 1,750 r.p.m. They are dressed occasionally with a diamond point tool, primarily to maintain the proper radius on the corner next the flange and are worn down until only about as thick as they are wide. The service life of each pair of grinding wheels is dependent on the type of wheel employed and the proportion of badly worn wheels. At the Western Avenue shop, one pair of grinding wheels will last to true the treads of 146 to 176 pairs of steel passenger-car

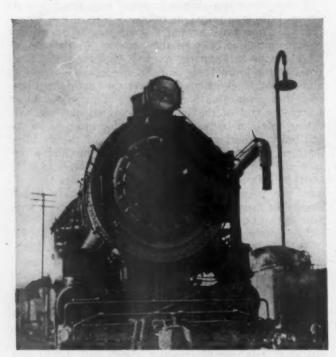
#### IN THE BACK SHOP AND ENGINEHOUSE

#### L. & N. Installs Improved Smoke Consumer

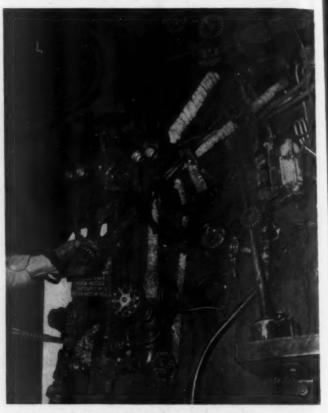
The steam-air jet for smoke abatement is an old idea and the first patent is said to have been granted to M. W. Ivison in England in 1838. Since that time, literally hundreds of variations of the original idea have been tried and some of them extensively used, but with rather meager and not entirely satisfactory results. During the last year or more, an improved steam-air jet, developed as a result of research conducted by Bituminous Coal Research, Inc., and extensive service tests on the Louisville & Nashville, has been installed on a number of L. & N. switching locomotives with outstanding good results, as shown in a public demonstration before city officials, smoke abatement engineers, railroad men and others at Nashville, Tenn., last October.

The principal difference between the new type of steam-air jet and the plain induction tube used on many roads is an air tube of optimum length, a smooth approach to the air tube, a steam nozzle accurately centered and positioned to give maximum air entrainment, and a silencer which acts like a muffler. This device is not patened or patentable and may, therefore, be made and used by any road interested. One of the illustrations shows three of these steam-air jets applied to the left side of an L. & N. switching locomotive and there are three on the right side applied in the same manner but staggered so as to give uniform coverage of the grate area.

The number and location of the induction tubes is important if good performance is to be obtained. They are horizontal and placed in the sides of the firebox. The tube nearest the fire door (generally on the left



The safety valve is open and the stack clear after placing 40 scoops of coal in the firebox



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Cab view of over-fire air valve and blower valve

side) should be located approximately 16 in. from the inside door sheet and about one bolt higher than the bottom of the firedoor opening. The tube nearest the fire door on the opposite side of the firebox should be located 28 in. or 29 in. from the inside door sheet; i. e., 12 in. or 13 in. ahead of the foregoing tube and at the same height above the mud ring. Successive tubes on either side of the firebox are spaced approximately 24 in. apart, and approximately 16 in. above the grate. The tubes may be lower toward the front to clear the arch. The induction tubes may replace staybolts, or be located between stay bolts. The locations stipulated have been found to give best results; and other appliances should be relocated, if necessary, to admit of obtaining such locations.

The number of air jets and induction tubes required on any particular class of locomotive is dependent upon the grate area and coverage desired. In the experience of the L. & N., it has been found that one 2½-in. induction, fitted with a 2¼-in, outside diameter air tube and 3/32-in. steam nozzle is needed for each 10 sq. ft. of grate area for locomotives in switching service with burning rates not in excess of 50 lb. per sq. ft. of grate per hour. If burning rates exceed this amount the steam nozzle may be increased in diameter to ½ in., which will take care of 80 lb. of coal per sq. ft. of grate per hr. Experience on the L. & N. indicates that it is not advisable to exceed a steam nozzle diameter of ½ in. for an air tube of 2¼ in. outside diameter. For Jocomotives in road service, burning rates much higher than the maximum in switching service are encountered and it is necessary

to increase the induction and air tubes to  $3\frac{1}{2}$  in. and  $3\frac{1}{4}$  in. outside diameter, respectively, dependent upon specific data covering grate width and length; heating

surface; etc.

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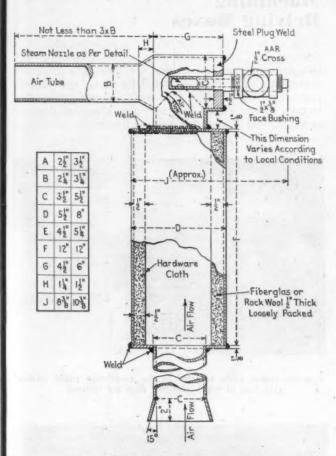
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The L. & N. steam-air jet shown in the drawing is an improved design differing from the ones shown installed in the illustration. It is the result of considerable laboratory experimenting to obtain satisfactory sound performance as well as capacity and maximum entrainment ratios. The ones in the photograph of the locomotive were loosely packed with steel-wool to give an acceptable sound level. The steel-wool, however, had the disadvantage of offering resistance to the flow of air by plugging with road dirt and disintegration due to rusting. The improved design effectively overcomes these handicaps and also gives superior results in lowered noise level. They are made principally from boiler tubes and flues and a set can be readily made in any railway boiler shop.

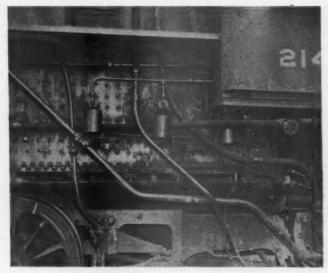
The steam-air jets are left turned on virtually at all



L. & N. improved Type A steam-air jet and silencer

times while the locomotive is under fire; while working in yards, standing and moving around shops and engine-houses; and whenever needed to avoid making smoke, such as while adding coal to the firebox, cleaning fires and building new fires. The stack blower is used for draft and elimination of smoke, following the general practice in this respect. The following instructions cover the operation of the device and if placed in a metal holder under glass in the cab, they will be accessible to the firemen and others.

(1) When going on duty, the fireman will first open the stack blower valve just enough to prevent the gases and smoke from coming out of firedoor and to raise the smoke from the stack,



Application of improved steam-air jets and mufflers to the left side of an L. & N. switching locomotive

(2) Open the smoke-consumer valve (indicated by a small plate "Smoke Consumer" and operated from the fireman's seat). Firemen will keep this valve open while on duty, in transfer as well as short switching service to provide a constant flow of air over the fire; also, the valve should be kept open after the locomotive is delivered to the enginehouse.

(3) Before leaving the enginehouse, see that the air induction tubes are in operation, i. e., blowing air over the fire. If not, have the steam nozzles cleaned.

(4) Place a bank in the firebox, higher at the door sheet than along the sides, but do not cover the induction tubes.

(5) If smoke is not altogether dispersed by the smoke consumer, gradually open the stack blower valve until the smoke is cleared up. Do not use the blower any more than necessary to free the stack of smoke.

(6) Maintain a U-tank at all times, and after adding

coal to the fire, keep the firedoor closed.

(7) The 1-in. globe valve under the operating valve to the smoke consumer is for enginehouse use only.

The Louisville & Nashville now has 50 switchers, one 2-8-2 heavy freight locomotive and two light 4-6-2 locomotives equipped with steam-air jets. Authority has been granted to equip a total of 99 switchers used at various terminals of this road. A number of other roads also utilize steam-air jets patterned after the L. & N. design.

#### One Way to Set Locomotive Valves

Here is a shop tested time saver that will save several man-hours on every engine that passes through the shop. In setting valves by trailing it has long been considered necessary to move the engine forward to square the forward motion, and then move it backward with the valve gear in the back-up motion to square the back-up motion. It has been found possible to square the back-up motion without moving the engine backwards, the valve gear is placed in the back-up position in the usual manner but the engine is moved forward when taking the back up travel marks. This method makes it possible to set valves on the fly while the engine is being cabled out

of the shop across the transfer table to the firing shed and gives a straight line movement out of the shop without the necessity of changing the cable to move the engine back and forth across the transfer table, while a number of craftsmen stand by waiting to get a chance to work on it. The method is sound in theory, for a little study will show that the direction of rotation of the wheels has no effect on the length of the valve rods and eccentric rods and that the effect of any lost motion will be the same regardless of the direction of rotation of the wheels.

#### Roll-Over Drum Disposal

Floyd Bliven, salvage supervisor at General Electric's Erie Works, developed this roll-over drum which easily disposes of wet grinding sludge, and similar waste. An open-top drum welded to a metal base plate is framed with two metal hoops, held rigid by angle-iron braces.



Disposal drum that can be handled and dumped by fork truck

The drum is easily transported by means of an electric fork truck from various machines to the drain. After lowering the drum to the ground, the operator moves the truck back until the fork tips are under the edge of the base plate. As the forks are slowly raised, the drum rolls over and the waste is emptied. The drum is automatically returned to an upright position by the weight of its base.

#### Questions and Answers On Welding Practices

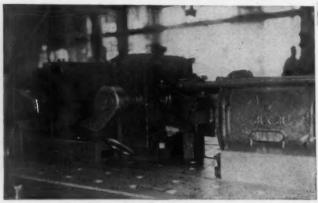
Safety in Welding

Q.—Is there any recognized standard code governing safety requirements for welding?

A.—Although safety factors involved in welding have been dealt with by manufacturers, insurance companies and others in the form of instruction pamphlets, the only work which might be termed a code has been prepared by the American Standards Association. The committee preparing a report on safety in electric and gas welding and cutting operations was composed of representatives of equipment manufacturers, users, insurance companies, the National Safety Council, and government regulatory bodies. The report was reviewed by hundreds of manufacturers and users and finally released under the title, Safety in Electric and Gas Welding and Cutting Operations, by the American Standards Association, 70 East Forty-fifth street, New York. Single copies sell for 40 cents. It should be remembered that this is not a legally binding code but a standard which is intended as a guide for the protection of workers from injury and illness and for the protection of property from fire or other damage arising out of the installation, operation, and maintenance of electric and gas welding and cutting equipment.

#### Machining Driving Boxes

A jig for mounting on the table of a planer is used at the Spencer, N. C., locomotive shop of the Southern to hold two driving boxes in position for necessary machining operations. The jig is operated by an air cylinder, the piston exerting pressure on a wedge-shaped guide which in turn rotates round bars to which clamping dogs are fastened. As the wedge guide advances it rotates the



A wedge-shaped guide operated by the air-cylinder piston rotates the bars to which clamping dogs are fastened



Clamping dogs hold the driving boxes firmly on the machine table

dog bars until they exert maximum pressure against the driving boxes which are mounted on each side of the ig. One dog fits on the inside of each box while another fits against the top of each, the boxes being held so firmly that maximum cuts can be taken without any possibility of the boxes moving.

#### Locomotive Boiler **Questions and Answers**

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Flow of Water Through Openings

Q.—If a fusible plug has an orifice of 1/2 in. diameter and the tin in the plug has been melted out, how many gallons of water per minute will be discharged through this orifice with a steam pressure of 250 lb. on the boiler?-L. S.

A .- The formula for computing the flow of water under pressure through an orifice is:

$$V = 0.98 \sqrt{2g (h + h_1)}$$

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V = velocity of flow in ft. per sec.

g = 32.16

h = head in ft.  $h_1 = P$ 

0.434

P = pressure in lb. per sq. in.; 0.434 lb. per sq. in. for one ft. of head.

The formula for quantity of flow is:

Q = 0.61 AV

when

Q = discharge in cu. ft. per sec.

A = area of orifice in sq. ft. V = velocity of flow in ft. per sec.

Applying these formulas to the problem in question assuming that the fusible plug burned out because of scale, there being three inches of water over the crown, the head h would then be three inches or 0.25 ft.

$$V = 0.98 \sqrt{2 \times 32.16} \left( \frac{0.25 + 250}{0.434} \right)$$

 $V = 0.98 \sqrt{64.32 (0.25 + 576)}$ 

 $V = 0.98 \ \lor \ 64.32 \times 576.25$ 

 $V = 0.98 \sqrt{37,064}$   $V = 0.98 \times 192$ 

 $V = 0.98 \times 192.5$  V = 188.65 ft. per sec. 0.19635 $Q = 0.61 \times \frac{0.17603}{144} \times 188.65$ 

Q = .1565 cu. ft. per sec. 1 cu. ft. = 7.481 gal. .1565  $\times$  7.481  $\times$  60 = 70 gal. per min.

#### Vertical Welds

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Q.—It is necessary to fabricate the sides of a tender tank from several plates joined with vertical butt welds. In making these should the direction of welding be up or down?-R. D. M.

A .- If possible, the sides of the tank should be welded in a horizontal position. Sections should be joined with as few vertical welds as design permits. The selection

of the direction of welding for vertical joints involves not only the direction of welding, but also the characteristics of the resultant bead and joint. Generally, it is easier to weld down. On certain joints it is quite difficult to weld up without the use of a backing-up strip. For example, on a single-vee butt weld it is very difficult to put in the first bead when welding up. When a backing-up strip is used, or the weld is a fairly heavy fillet, or the type of joint has good heat capacity, welding up may be done fairly easily. Care must be taken to eliminate slag and incomplete fusion at the side of the bead to avoid undercutting.

Welding down produces a concave bead, with practically no undercutting and fine-grain structure due to multiple beads, with resulting greater cleaning time because of the greater number of beads. On the other hand, welding up produces a more abrupt change in contour at the toe of the bead. The bead is convex and fusion is more easily obtained at the heel of the bead.

It is obvious that to recommend only one direction of welding is impossible unless the type of joint, the type of electrode, and what is required in the completed joint are known.

#### **Ground Glass Inspection Plate**

An illuminated ground glass inspection plate has been devised at General Electric's Pittsfield Works as a simple quick means of checking angles on tools or matched cutters. The glass is set in a wooden frame at an angle of approximately 65 deg. The light source under the plate is a standard 100-watt lamp.

The tool being checked is placed on the plate and the



Angles are readily checked with this illuminated background

protractor or template is placed against the side of the tool. Any error is immediately discernible. The method provides a positive check against the true cutting edge of the tool, which is not always possible when the protractor is held in one hand and the tool in the other.

This inspection plate is inexpensive and simple to make, and can be replaced easily if broken. It can be used by inexperienced persons, and is adaptable to a variety of inspection jobs.

# Safety Factors in Arc Welding

THERE is one peculiarity which distinguishes the arcwelding operator's job from other occupations. Arc welding is the only widely practiced industrial occupation in which the operator handles a live electric circuit all



Fig. 1-Atomic-hydrogen arc welding on aluminum

day. Yet, in spite of all the implications of that fact, the danger of electric shock to the operator is not as great as is often supposed.

In addition to electrical hazards, arc-welding operation involves some fire risks as well as the ordinary mechanical hazards to the workman which are common to almost any industrial occupation. But these are not peculiar to arc welding. The presence of fumes and smoke is likewise not peculiar to the arc-welding process, and ordinary means of dilution and removal are employed. The medical aspects of this matter are the subject of careful investigations in a quantitative way, but they all point to adequate ventilation as the practical hazard-preventative measure.

Radiation of ultra-violet and infra-red wave lengths from the arc are sometimes regarded as serious hazards. They are not, in the sense that their effects can easily be prevented by commonly used protective helmets and clothing. Mystery rays are not present, although it is surprising how many times the rumor crops up that this or that arc-welding equipment gives off radiations which result in sterility or peculiar ailments such as might be attributed to X-rays. Such rumors have been disposed of effectively by having welding operators carry in their clothing pieces of photographic film for weeks at a time. None show the slightest evidence of radiation.

#### Electric Shock

The hazard of electric shock is the one of greatest interest in arc welding. It is not as common a source of injury or death as might be suppposed from casual By R. F. Wyer\*

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A discussion of the hazards and required safety practices from the electrical point of view

acquaintance with the subject, and because there are definite ways in which even the small hazard can be almost completely overcome. It is difficult to compile records of shock casualties because insurance statistics are not broken down quite far enough to reveal the needed data. Also, rumors and newspaper publicity are notably inaccurate when dealing with deaths in the arc-welding field. The following are reports of one accident from different papers in the same city. "Stumbled and fell in such a manner that the electrode on his welding instrument was jammed in his mouth. The charged connection sent 550 volts through his body, killing him instantly." And, "Fell dead after 440 volts passed through his body. His heavy clothing, which all workers in the shop are required to wear for safety, was soaked with perspiration and, as he accidentally touched a highly charged arc rod used by another worker, a short circuit was caused and the power passed through his body." As a matter of



Fig. 2—Tank and boiler construction and repair frequently requires working in confined spaces

<sup>\*</sup> Application engineer, Electric Welding Division, General Electric Company.

fact, careful measurements immediately following the accident showed a maximum of 76 volts available to shock the victim.

Some concrete information is available, and it shows a perhaps surprisingly small number of fatalities from this source. One insurance company reported that among one group of policy holders, electric shock was the least



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Fig. 3—This operator is using an uninsulated electrode holder and the cables coiled carelessly under his feet and legs may trip him when he rises

frequent cause of occupational death classified—fewer deaths being attributed to shock than to falls, machinery, railroads, or even drowning. This in spite of the fact that the group must have included electricians and workers in electrical manufacturing plants, and in spite of the often evidenced tendency to attribute death to electrocution in any doubtful case where a live electrical conductor is present at the scene.

In a survey made among four manufacturers using arc welding, selected at random and not including General Electric, these figures were obtained for the year 1941: There were a total of 14,475 industrial workers employed by the four manufacturers, with a total of 13 fatalities, or one death per 1,110 workers. Included in these totals were 1,125 arc welders, among whom there was one fatality

G. É. plants have for many years employed arc welders, with as many as 1,500 welding operators employed at one time before the peak in this employment. In the last seven years there has been but one fatal accident to a welding operator. This one was in 1938, and there is considerable doubt as to whether death was caused by electrocution or by a fall.

The district supervising engineer of one large insurance company stated in 1942 that, as measured by compensation rates, arc welding is only 75 per cent as hazardous as gas welding. Yet gas welding is not generally considered a very hazardous occupation.

In 1942, still another insurance company reported

about one electrocution case per month for the preceding two years, only two of which involved arc welding. These two cases were the only ones they had had for many years.

While no figures on the total employment of arc welding operators are available, a conservative estimate based on industry sales of arc-welding equipment and on the consumption of electrodes gives a figure well over 200,000 for the year 1943. So far, available records indicate only four electrocutions among arc-welding operators during the entire year 1943. The shock hazards which do exist might be classified with relation to equipment and its layout, maintenance, supervision, and operator education.

#### Circuit Voltages

Fig. 1 shows atomic hydrogen arc-welding equipment in operation, and brings up the perpetual question of the relative hazard in a. c. and d. c. welding. Here there is at times a potential of 300 volts between the two slender electrodes projecting up and to the left from the arc. It is alternating-current. No case of severe shock, and no fatalities resulting from the use of this equipment have ever come to our attention.

The point is made to demonstrate the fallacy of arguments, based on clinical or laboratory experience, as to the difference between a. c. and d. c. with respect to shock hazards. In this equipment an adequately insulated electrode holder is used, and factory designed and built protective equipment disconnects the power when the arc is not actually in use.

Exhaustive studies on let-go currents, made at the University of California, definitely prove that under laboratory conditions a victim is less likely to freeze onto an electrode with d. c. than with a. c. at a given current in milliamperes. But to draw the conclusion that d. c. welding is invariably safer than a. c. welding is to ignore the factors of voltage, insulation, protective equipment, skin resistance, and physical condition of the subject.

The extremes to which interpretations of these tests may go is indicated by the recent development of a theory, by a welding supervisor, that while 24 volts is



Fig. 4-The insulation of this electrode holder is broken

safe, 28 volts is dangerous. Or by the performance of another welding supervisor, who knelt in water on a steel deck and grasped an electrode with soaking wet gloves, to demonstrate that one can feel 35 volts, but not 10 or

12. If such a demonstration ever convinces a welding operator that it is safe to place the body intentionally across any electrical circuit, it may well be a contributing factor to his untimely death.

Most welding sets receive power at voltages from 220 to 550, but the welding circuit on all properly designed machines which may develop 50 to 100 volts is effectively separated from the power circuit by the insulation in the machine or transformer. Some a. c. welders have a built-in control panel which automatically reduces the voltage on the welding circuit to about 30 volts within one-fifteenth of a second after the welding arc is extinguished, as when the electrode must be changed. Touch-

Fig. 5—Arc-welding operator should never sling electrode holder over his shoulder, nor leave an electrode in a holder not in use

ing the electrode to the work automatically puts full power on the welding circuit again.

#### Grounding

The major safety point in the installation of arcwelding equipment is the necessity of grounding the frame of the welding set, whether it is an a. c. or d. c. unit, or whether it is stationary or portable. Common sense, as well as the National Electrical Code, demand that this should be done. An ungrounded unit, even one in perfect condition, can give annoying shocks and tickles to a grounded individual, because of the inherent ability of an electrical circuit to induce a static charge on another conductor separated from it by insulation. The effect is the same as that in a condenser, or Leyden jar.

In the event of failure of the insulation, due to age, abuse, or accident, the frame of a unit may become

charged to full power circuit voltage, with serious consequences, unless the frame is grounded. If the proper ground connection is in place, however, the frame cannot have a voltage to ground, and the only effect of such a failure will be the blowing of fuses or tripping of circuit breakers and disconnection of the unit from the line.

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This immediately suggests the necessity of installing adequate overcurrent protection and switches in the power circuit to the welder. Fuses or circuit breakers must be capable of interrupting the maximum current which may be drawn by a short circuit in the motor or power leads of a d. c. welder, or in the primary circuit of an a. c. welder. Disconnecting switches must be capable of interrupting the stalled rotor current of the d. c. machine, or the maximum current which can be drawn by the a. c. unit when the welding electrode is short-circuited on the work.

On the welding-circuit side of a unit, care should be taken to avoid the possibility of getting double the normal circuit voltage between two adjacent welding circuits, because of the connection of one unit with one polarity, and the other with opposite polarity. On a. c. units, abnormal voltage of somewhat lower value can also be obtained if adjacent welders are operated from different phases of the supply line. This factor has rarely, if ever, caused serious trouble because of the small likelihood that an operator will get hold of two welding circuits at once.

#### Electrode Holders

Probably the most important item in equipment, from the safety point of view, is the electrode holder. Although uninsulated holders have been used in arc weld-



Fig. 6—Arc-welding operator should be particularly careful when working above the floor or ground, since many fatalities are caused by falling

ing for many years, good practice unquestionably requires that fully insulated holders should be used.

Fig. 2 not only shows an uninsulated electrode holder but, incidentally, an ideal set-up for potential trouble. The operator is in a cramped space, and also undoubtedly in contact with the conducting metal in a number of places on his body, unless his clothing is dry and his shoes free from nails. In his hand he holds an electrode holder which has a handle of insulating material, but through which extends an uninsulated screw-head. Probably any contact he might make with the screw, through wet gloves or with the bare hand, would be too small in area to permit electrocution. But a shock may make him do something involuntarily, which will put him in danger. The worst feature of this holder is that the head, projecting out beyond the ring or collar of insulating material just above the hand, is entirely uninsulated. Each time the operator changes welding electrodes, there is a good chance that he will contact this exposed metal. If he should fall on the holder, or sling the cable over his shoulder or around his neck, as is frequently done, this live conductor may contact his chest or back.

There are now several types of good insulated electrode holders on the market. They should be used on any welding job, and their insulation should be kept in first-class condition. Studies of accident reports reveal, in a good percentage of cases, evidence that uninsulated electrode

holders caused or contributed to death.

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#### Maintenance and Supervision

Maintenance and supervision play an important part in the safety side of welding, as is the case in almost any other process. Fire hazards should obviously be watched for and, when found, eliminated. Welding cables and their connectors should be examined frequently for breaks in insulation. The extremely hard service to which welding cables are subjected often results in severe damage to the insulation. Yet the welding operator, accustomed to arcs and sparks in his daily work, often disregards accidental short circuits which spell trouble to the safety man or the fire inspector. Likewise, welding return-circuit connections should be given attention, by supervision. Arcs or flashes in unexpected places along the return path of the welding current may result in fire hazards if indiscriminate use is made of returns consisting of building piping, reinforcing rods, scrap lengths of pipe, or bars laid together.

The maintenance of adequate safety ground connections to the frames of all welding machines should be checked, because many operators do not realize their importance. For the same reason, the maintenance of insulation on electrode holders should not be left to operators alone. Electrical repairs and connections on the power-line side of the welder should be handled only by competent men. In the last analysis, it is obvious that the welding operator and his safety education plays the greatest part in preventing accidents to himself.

#### Safety Rules

The paramount warning should be to take particular care in hot and humid weather, and when welding in wet places. Almost without exception, fatal accidents to welders occur in hot weather. The operator's own condition and that of his clothing should be his guide. He should always guard against wet gloves, shoes, and clothing, particularly clothing made of thin cotton fabrics.

The operator should assume the major responsibility for seeing that the insulation of the electrode holder is in

good condition.

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ode but He should learn to carry an electrode holder by the handle, never slung over his shoulder, or squeezed under his arm.

He should never, under any circumstances, transport an electrode holder with an electrode or electrode stub in it.

He should never throw or lay an electrode holder down so that it makes contact with any conducting material.

He should never work alone in confined or concealed



Fig. 7—Electrode holder should never be thrown or placed where it can make contact with conducting material

spaces where, for example, striking his head may cause temporary loss of his faculties.

He should be particularly careful when working above the ground or floor, since it is significant that many

fatalities involve a fall.

Case studies, incomplete as they usually are, give a basis for these recommendations. For example, in all but one of nine reports of accidents, dating from 1934 to 1943, the statement was made that the weather was very hot, or that the victim's clothing was soaking wet. In five of these nine cases, a fall was involved, ranging from a height of eleven feet to the case of a standing man who fell to a steel floor. In every one of them, the electrode holder was uninsulated, and in none was there evidence of contact with any live part other than the electrode holder. Four of the cases involved arcwelding operators working in confined spaces.

This discussion can be summarized as follows:

1.—Arc welding is not a hazardous occupation, as judged by industrial standards.

2.—Electric shock is a relatively infrequent cause of

death.

Where electrocution of the welding operator has occurred, one or more of three factors was usually involved: (1) an uninsulated electrode holder; (2) wet gloves and clothing; (3) a fall.

#### Grounding of Circuits On Cars and Locomotives\*

A study of the National Electrical Code and other safety regulations with reference to circuit grounding indicates that inside circuits are grounded to limit the voltage which may be impressed on a circuit by exposure to, or conflict with, higher voltage lines; or to limit the maximum potential to ground which may result from the normal operating voltage.

These limitations, which grounding is supposed to impose, are sought primarily in an endeavor to reduce the hazards from fire and electric shock or burn. A secondary objective is to minimize the hazards to service; for example, service interruptions. Also, circuits may

\*Abstract of a paper, "Grounding of Circuits on Self-Propelled Vehicles," by D. D. Ewing, professor of electrical engineering, Purdue University, presented at the winter technical meeting of the American Institute of Electrical Engineers in New York, N. Y., January 22-26, 1945.

be grounded to facilitate trouble indication and location, to provide for more accurate and reliable circuit protection, and, in some cases, to simplify the circuit layout and to allow a more economical construction.

The circuits which are used in self-propelled vehicles

may be classified rather arbitrarily, as

(a)—Single-conductor circuits with "ground" returns. In a vehicle the ground return is a path through the locomotive or bus frame from the motors to the power In the ordinary electric-railway distribution system the track rails and ground form the ground return to the power supply.

(b)—Two-conductor circuits with both conductors in-

(c)—Two-conductor circuits with one conductor grounded. The "ground" may be at one point or at several points. It may be a "dead" or solid ground, a ground through a resistance, a fuse or a protective relay of some sort, or through a combination of these com-

As used here the term "vehicles" includes electric locomotives steam-electric locomotives, Diesel-electric locomotives, storage-battery locomotives, street-cars, electric motorcars, trolley buses, gas-electric buses, Diesel-electric buses and gas buses, and automobiles used in public transportation service. Also, the foregoing classification covers only d.c. and single-phase a.c. circuits.

In the selection of the proper circuit for a given service the engineer does not always have a free choice. For example, the power circuits of electric motorcars and locomotives which operate on rails and receive their power from an outside source ordinarily must use the class (a) circuit. Similarly, for practical reasons, the main circuits in a trolley bus must belong to class (b).

The choice is not so restricted, however, for the fol-

lowing circuits:

1-Traction motor circuits on steam-electric, Dieselelectric, and conversion-type electric locomotives.

2-Main power circuits on gas-electric and Dieselelectric buses and trucks.

3-Starting, lighting, and other auxiliary services on buses, trucks, and automobiles.

4—Auxiliary circuits on electric motorcars, locomotives, and trolley buses.

5—Electric circuits on railroad passenger cars.

This lack of restriction has resulted in a considerable diversity of opinion among engineers with a corresponding diversity of practice among equipment users.

Common questions which arise are: Should the main power circuit on a Diesel-electric or gas-electric bus or locomotive be grounded or kept well insulated? grounded, should the ground be a solid ground or a resistance ground? Should the circuit be grounded through a fuse or a relay? Should control, lighting, and other auxiliary services use grounded or ungrounded

The outstanding advantages of the single-conductor ground-return system are simplicity of circuit layout, low first cost, and the quick detection and ease of location of faults. Its disadvantages are the lack of constancy in circuit resistance and the fact that a fault on the single conductor may render the circuit inoperative at some time when operation of some sort is absolutely necessary. Circuit-resistance variations are caused by loose rivets, bolts, joints, and so forth, in the mechan-These poor contacts may result in burning and corrosion of the metal frames and leakage through the bearings may cause serious bearing trouble.

The system of employing two insulated conductors has the advantage of making possible a high degree of cir-

cuit insulation and isolation. It is practically the only choice for all circuits fed by trolley voltage in the trolley bus. Circuit resistance is easy to maintain at a constant level and the likelihood of failure is less since there must be a fault on each line before complete circuit failure can occur. This advantage becomes a real disadvantage, however, when the matters of fault indication and location are considered. This circuit costs more and there seems to be a trend toward its increased use in the better class of vehicles. In some services, where a common return wire is used, the insulated circuit is at a disadvantage as compared with the ground-return circuit. This is notably true in the case of certain control and signal circuits where an opening in the common return wire might cause false indications or false operation.

Circuits of the third class (those with two conductors, one of which is grounded) have a wide field of application, potentially at least. They are high in first cost and maintenance but provide current paths of constant resistance and a ready means of fault indication and location. Such circuits appear to be particularly applicable to the traction motor circuits on a.c. and Diesel-electric locomotives and, in general, wherever a circuit path of

high integrity is required.

#### Conclusions

Giving due consideration to matters of economy, circuit requirements from a power standpoint, and to the reasons underlying circuit grounding, the following con-

clusions may be drawn:

1-All circuits on trolley buses which operate at trolley potential must be of the two-conductor type with all wires and apparatus well insulated from the bus body and other parts accessible to passengers or street

2-All low-voltage circuits on small buses and automobiles used in passenger service may be of the one-

insulated-conductor ground-return type.

3—All circuits carrying small currents at low voltages (6 to 32 volts) which are thoroughly isolated from possible exposure to, or conflict with, higher voltages and which are accessible in any way to passengers or street traffic may be of the one-insulated-conductor groundreturn type.

4-Ground-return circuits should not be used on trucks or other vehicles carrying gasoline, oil, or other

highly inflammable or explosive materials.

5—All so-called "ground-return" circuits, where there is possibility of a loose mechanical joint in part of the return circuit, should have the return of bare copper conductors electrically connected to the mechanical parts

at a number of points.

6—All internal circuits carrying heavy currents at both low and high voltages (starter-motor circuits on automobiles and small buses excepted) may be of the twoinsulated-conductor type with one conductor grounded. The two conductors here serve as a guarantee of circuit integrity and the grounded connection is of assistance in fault indication and location, keeps static charges drained off, and otherwise assists in protecting apparatus and This classification is not intended to include service. circuits which are fed from an external source such as trolley wire or third rail.

7-All circuits on rail vehicles connected to external sources of power such as trolley wires and third rails are necessarily of the one-conductor-with-ground-return type or of the two-conductor-with-one-conductor-

grounded type.

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## THE 7 RIGID TESTS THAT GUARANTEE UNIFORMITY

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- 1. Chill test block taken at least once in every ten wheels poured.
- 2. One complete chemical analysis with each heat.
- 3. Constant pyrometer checks for accurate processing temperature.
- 4. Drop test of finished wheel (A.A.R. Specifications).
- 5. Thermal test of finished wheel (A.A.R. Specifications).
- 6. Test for Rotundity.
- 7. Brinell Hardness test for maximum and minimum chill limits.

# 37.36 or 38.

## 7est No. 6

## **TEST FOR ROTUNDITY:**

Rotundity is an extremely important consideration in a car wheel, so much so that the A.A.R. Specifications place a limit of 1/32-in. on this feature.

The process employed in the manufacture of chilled car wheels is admirable from the standpoint of achieving rotundity.

A chiller ring is employed, which forms the flange and tread section of the mold into which the molten metal is poured.

This chiller ring is machined to perfect rotundity, to produce the prescribed tread and flange contour, and the casting naturally follows the contour of the accurately machined chilling surface of the chiller.

Accompanying drawing shows the A.A.R. standard gauge for checking the rotundity of wheels.

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8—Control and signal circuits using a common return wire may have this common return grounded on car or truck frames at a number of points whenever other circuit conditions are such as to permit grounding. The grounding of the common return will tend to reduce false indications or operations in case of return-wire breakage.

9—Three-phase 220-volt circuits used on railroad cars to supply air-conditioning equipment should not be grounded. However, the structural parts of the cars

should be solidly grounded.

10—All a.c. and d.c. circuits on railroad cars with voltage ratings of 64 to 120 volts should be of the insulated-conductor type. If an a.c. circuit is fed through a transformer from a higher-voltage circuit then the lower-voltage circuit should have one conductor grounded. Also, if such a circuit is exposed to static from belts or moving air streams, one side of the circuit should be grounded.

It does not seem feasible to make a complete classification of all the circuits used in vehicular service and categorically state that such and such circuits should always be grounded and certain others should not be. The safety, economic, and technical factors are somewhat different in the different transportation fields, and these factors should be given some weight in the consideration of any recommendations relative to stand-

ardization.

#### Recommendation

Standards in some of the operating fields have been set up by the American Association of Railroads, in others by the Society of Automotive Engineers, and in still others by the American Transit Association. In those fields where these several associations have what for convenience may be called primary jurisdiction, the standardization problems have on the whole been cared for promptly and effectively. Under present conditions there is a considerable amount of overlapping. For example, the power equipment on a Diesel-electric locomotive from one viewpoint may be considered as just overgrown Diesel-electric bus equipment. The question arises as to who shall set up the needed equipment standards in such a case? Shall they be set up by manufacturer's associations, by professional engineering groups, or associations of operating companies? The question is a difficult one. Obviously some things belong in one place and some in another. In this case it is possible that better end results will be produced if the work is done by joint committees working under the sponsorship of a professional engineering group. would seem to be a proper recommendation, therefore, that the American Institute of Electrical Engineers act as sponsor in this instance and set up the necessary mechanism for working out the desired standards and recommended practices.

#### Germicidal Lamps In Railroad Service

In an effort to prevent the spread of colds and other contagious diseases, the Union Pacific is installing ultraviolet lamps in the bar cars of the City of Denver and plans to introduce them eventually on all of its streamliners. The lamps are arranged so that the rays are directed upon racks of washed and dried bar glasses. Ultra-violet lamps have also been placed over work

tables in the commissary at Omaha, Neb., where from 1,200 to 2,000 box lunches and 12,000 additional sandwiches are prepared daily.

These innovations for the protection of passengers, according to H. I. Norris, assistant to the manager of the dining car and hotel department, follow experiments with the lamps in the refrigerators on some of the streamliners and in meat aging refrigerators at Omaha to prevent waste and spoilage of food due to the growth of mold.



Sterilizing lamps set in troughs above meats in the disbursement room at the Union Pacific's Omaha, Neb., commissary—Temperatures can be raised 10 deg., cutting down wear and tear on refrigerator machines

"In pre-war days when we featured broiled steaks on our dining car menus," Mr. Norris said, "the sterilizing lamps in the aging boxes saved about \$500 a month by preventing shrinkage of beef loins and ribs. We estimate that we save from \$150 to \$400 a month on fruits and vegetables through the prevention of mold and spoilage."

#### Silicones As Insulating Material<sup>†</sup>

Early studies and most subsequent investigations of the life of insulation were based on the mechanical durability of insulation. However, they did not emphasize the fact that the thermal behavior of insulation is doubly important because of the effect of aging on moisture resistance. The term "insulation life" implies that after a certain period of aging the useful life of the insulation is expended or that there is a fairly definite end-point. However, life is a variable thing and it is preferable to consider that the actual value of insulation life in the laboratory depends on the tests or criteria used to determine the end-point. Likewise service conditions determine the life in normal operation. The use of very severe tests, or severe operating conditions, will result in a minimum life which may be only a fraction of the maximum life end-point obtained by less rigorous con
(Continued on next left-hand page)

† Abstract of a paper by T. A. Kauppi, Dow-Corning Corporation, and G. L. Moses, Westinghouse Electric & Mfg. Company, presented at the winter technical meeting of the American Institute of Electrical Engineers in New York, January 22-26, 1945.





# NOW SPEED C&O TRAFFIC Over Tough Mountain Grades

In 1940 the Chesapeake & Ohio ordered ten 2-6-6-6 Super-Power Limas, specially designed to haul heavy trains on tough mountain grades. So satisfactory did they prove, that

the fleet of these powerful, four-cylinder, six-coupled articulated locomotives has been steadily increased until forty-five of them are now speeding C & O traffic over the Alleghenies.

LIMA LOCOMOTIVE WORKS



INCORPORATED, LIMA, OHIO

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gineer 1945 ditions. Since one of the most important functions of an insulating varnish is to exclude moisture from the electrical windings, it is the opinion of the authors that minimum life of a varnish film may be taken as the point at which a hazardous reduction in moisture resistance occurs.

Silicones are derived from sand, brine, coal and oil as ultimate source materials. However, like certain of the organic high polymers which are said to come from coal, air and water, their synthesis involves a number of steps and a considerable amount of industrial and chemical technology.

#### Liquid Silicones

One of the first groups of silicone polymers to reach commercial production was the liquid silicones. Several families of these silicone fluids are now available in a wide range of viscosities. They are characterized in general by the properties of low change of viscosity with temperature, low freezing point, unusual inertness and stability to heat. The silicone fluids are finding application as gauge liquids, damping fluids, and in various hydraulic applications. An interesting application is the use of a dilute solution of silicone fluid for treating ceramic surfaces to render them water-repellent. The low dissipation factors of these liquid silicones at elevated temperatures or at high frequencies and their inertness to moisture indicate them for use in liquid filled condensers.

#### Silicone Resins

Silicone resins are available in two principal types. The first is the insulating varnish type, which is comparable in physical properties to organic oleo-resinous varnishes. The baking temperatures required to cure the currently available silicone varnishes are sufficiently high (200-250 deg. C.) to prohibit their use on organic materials; whereas organic varnishes may be used to coat cotton, paper, silk or wood, silicone varnishes must be used with inorganic materials, such as glass fiber, asbestos, mica or ceramics. The silicone varnish is used to coat glass-served magnet wire and fiber glass cloth, and is used as a binder for building up flexible micaglass laminated sheet. It is also used as the final impregnating and coating varnish to bind together the individual machine component and water-proof the complete assembly.

The second type of silicone resin corresponds in general behavior to the organic thermosetting resins normally used to make rigid laminated insulating parts. These more recently developed thermosetting silicone resins are being used to bond fibrous glass and asbestos laminated structures, and to impregnate special coils requiring hardness and rigidity.

These two types of silicone resin provide the means for constructing electrical machines which contain no organic materials. The thermal limitations of the complete insulation may be raised to such an extent that thermal aging of the insulation can be ignored in the design process. Factors other than insulation aging will then ordinarily establish the normal operating temperature of the machine at a point well below the temperatures which could be permitted when silicone insulation will be used.

#### Conclusions

It is important to recognize that the use of silicone resins in electrical insulation need not represent any radical departures from well established purposes. Inorganic components of high temperature insulation have long been available and their characteristics proven. It was the organic bonds, impregnants and surface treatments which limited the thermal endurance of composite insulation containing mica, asbestos and fibrous glass. Silicone resins should be used in combination with these well known materials. References made in this paper to "silicone insulation" imply the substitution of silicone resins for all the organic resins in the better grades of Class B insulation and do not refer to the use of silicone resins as mica substitutes in any way.

Innumerable tests in the laboratory and over fifty years of service experience have demonstrated that thermal aging is the most important single factor in insulation life. Only after such aging occurs does good insulation become vulnerable to the other ills which plague it. Differences in the thermal endurance of various types of insulation have been clearly demonstrated to be a function of the stability of their essential components. Therefore, the recent development of silicone resins promises great improvement in thermal stability of insulation for electrical machines as it improves the weakest link in the insulation system. This improvement properly utilized by designers can be a great asset to the industry. There is no point in increasing operating temperatures unless some useful economic purpose is served, but where electrical machinery must operate at elevated temperatures, silicone resins and high temperature insulation offer a solution to a previously unsolved problem.

Silicone resins have been demonstrated to have thermal stability far beyond that of the best of the conventional organic materials. It therefore appears timely to reexamine the thermal endurance requirements for insulation of electrical machinery, to evaluate the possible advantages from the use of these more heat resistant materials and to seek means for utilizing them for the improvement of electrical machinery where there use is justified. These general problems should be investigated and tests made by as many interested engineers as possible so that a broad perspective is obtained promptly.

#### Silicones As Lubricants\*

A translucent silicone grease of vaseline-like consistency has been developed for use as a lubricant for ignition cables to reduce corona cutting of the insulation and permit easy wiring of ignition harnesses. It is stable to heat and retains its vaseline-like consistency from —40 deg. C. to 200 deg. C. Although it is a soft grease in appearance, it has the unusual property of not melting on exposure to heat. This material also is inert and oxidation resistant. It has no solvent effect upon synthetic insulations or rubber, and tends to prevent the hardening of these materials when heated in contact with air.

Other greases under development are being used for lubricating ball and roller bearings. One type can be used at temperatures as low as -60 deg. F. and has high-temperature stability at least as good as the best available organic greases. Another type of silicone lubricating grease is showing stability in ball bearings several times as great as organic greases at the same temperature.

<sup>\*</sup> Abstract of a paper by T. A. Kauppi, Dow-Corning Corporation, and G. L. Moses, Westinghouse Electric & Mig. Company, presented at the winter technical meeting of the American Institute of Electrical Engineers in New York, January 22-26, 1945.

## THE FRANKLIN SYSTEM OF STEAM DISTRIBUTION

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## FULL BOILER CAPACITY

WITH conventional cylinders, valves and valve gears, there are definite design limitations which prevent the full utilization of boiler capacity.

The Franklin System of Steam Distribution entirely eliminates these design limitations, and makes possible the full utilization of the potential boiler capacity, insuring a substantial increase in horsepower output and productive capacity.



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#### NEW DEVICES

#### A Large Drop Table

The illustration shows a drop table, made for installation at the Livingston, Mont., shop of the Northern Pacific. This drop table is said to be the largest ever produced by the manufacturer, the Whiting Corporation, Harvey, Ill., both from the standpoint of size and lifting capacity.

The drop table will lift 150 ton and the top is 23 ft. long by 11 ft. 8 in. wide so that either two or three pairs of locomotive driving wheels can be handled at one time.



Whiting 150-ton drop table assembled at the manufacturer's plant preliminary to shipment for installation at the Northern Pacific shops, Livingston, Mont.

There is a small top within the large top, known as the horseshoe design, so that single pairs of wheels can be readily handled. Another feature of this drop table is the provision of twin hoisting units with motors synchronized to operate in unison.

#### Demagnetizers For Cutting Tools

A line of demagnetizers for removing the magnetism from tools, drills and punches, and thereby preventing excess heat and wear caused by the adherence of magnetic chips, has been announced by the Special Productions Division of the General Electric Company. They are also useful for demagnetizing various machined parts, thus releasing fine adhering particles which often cause severe wear and impair accuracy and appearance. In addition, they can be used to adjust and stabilize the magnetic flux in permanent-flux assemblies for such applications as electric instruments and control devices.

Consisting of a cylindrical air-core coil, mounted in a sturdy stand at a convenient 45 deg. angle, the demagnetizers are available in a 4-in. size, rated 115 volts, 60



The object to be demagnetized is placed inside the unit and withdrawn slowly

cycles, a.c., and in 8-in. and 12-in. sizes, rated 220/440 volts. Long flexible leads for connection to the power line are furnished with the 4-in. size, while a small connection box behind the coil of the larger sizes accommodates standard electric conduit.

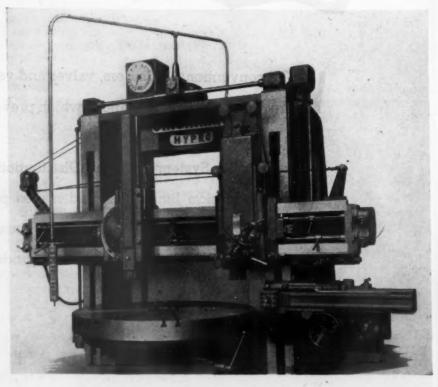
In operation, rated voltage is applied and

the material to be demagnetized is either passed directly through the coil or placed in its center and slowly withdrawn about two feet along its axis. At that point the magnetic field is negligible, and the material is then demagnetized.

#### Push-Button Control Of Boring Mill Speeds

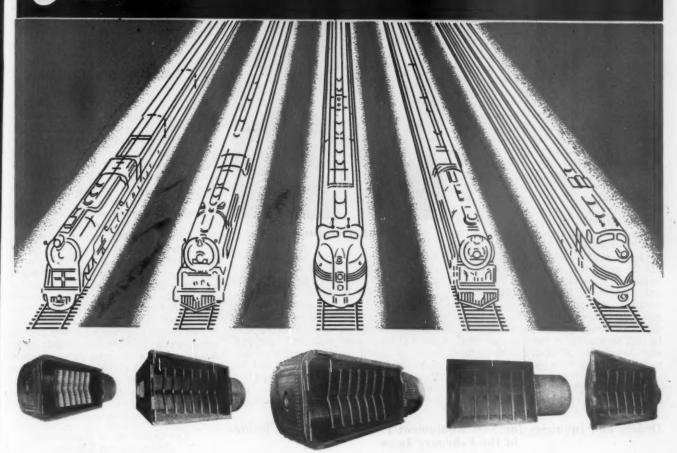
Conventional gear-shift changing of speeds has been replaced by finger-tip speed control by the addition of Hypro drives to the tables of boring mills manufactured by the Cincinnati Planer Company, Cincinnati, Ohio. This gives a complete range of table speeds under cutting loads ordinarily encountered through push-button control from the operator's normal working position, The table need not be stopped nor gears changed. A multi-point, fine-increment motor rheostat used in conjunction with the drive makes table speeds available which are suited to the job being done instead of the compromise speeds which are a part of manually operated gear shifts.

Heavy-cutting requirements at low speeds are met by a suitable back gear operated by a single lever. A fine inching control in both directions of table operation speeds set-up work. A large speed dial mounted on top of the boring mill gives instant indication of table speeds to the operator and pre-set table speeds can be checked at a glance.



Boring mill equipped with push-button control of table speeds

# JOCOWOTWE AVAILABILITY



Besides safeguarding the boiler by assuring a continual flow of water over the center of the crown sheet, Security Circulators have many other advantages that increase Locomotive Availability.

- They reduce honeycombing, flue plugging and cinder cutting.
- They form an ideal support for arch brick and increase the life of the brick.
- They permit the use of a 100% arch and promote better combustion.
- They increase the strength of the firebox structure and tend to prevent boiler distortion.

For these reasons the installation of Security Circulators helps to make locomotives available for continuous operation over longer periods of time and also lowers maintenance costs.

AMERICAN ARCH COMPANY, INC.

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SECURITY CIRCULATOR DIVISION

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## NEWS

#### **Prest Appointed Engineer Tests** Chilled Wheel Association

SAMUEL C. PREST has been appointed engineer of tests of the Association of Manufacturers of Chilled Car Wheels with offices at Chicago, to succeed George J. Weber who died in Chicago on January 20.

#### L. B. Sherman Dies

LUCIUS (LOU) BOOTH SHERMAN, Who retired on pension as senior vice-president of the Simmons-Boardman Publishing Corporation at Chicago early in 1941, died in Presbyterian Hospital, Chicago, on January 24. Mr. Sherman, who would have been 82 years of age in April, had been ailing for several months and entered the hospital in December. He died in his sleep.

Throughout his many years of activity, including more than 50 years' association with the railroads and the railway supply industry, Mr. Sherman, because of his personal qualities, was one of the most widely known and popular men in the business paper publishing and railway equip-ment and supply fields. During his career, Mr. Sherman took an active part in the Railway Manufacturers Supply Association and the National Railway Appliances Association, serving as a member of the executive committee of the former and a director of the latter for a number of years. In 1925 he was one of the American Railway Association's delegates to the International Railway Congress at London,

Mr. Sherman was born in Chicago on April 18, 1863, and after attending the



L. B. Sherman

University of Chicago, he immediately chose the selling phase of the publishing business for his career. In 1884 he entered the employ of the Railway Review and soon after rose to business manager of that publication. Later he resigned to become associated with the Railroad Gazette and on November 1, 1901, was promoted to western manager of that publication. In 1908, the Railway Age and the Railroad Gazette were merged under the ownership of Railroad Gazette, Inc., which

was succeeded in 1911 by the Simmons-Boardman Publishing Company, of which Mr. Sherman became a vice-president. In 1928, when the Simmons-Boardman Publishing Corporation was organized to take over the Railway Age, the Railway Mechanical Engineer, other railway publications, Marine Engineering, American Builder, and other papers in the building field, Mr. Sherman was elected vice-president of the new company.

#### A.A.R. Mechanical Division

REPAIRS TO TANK CARS

THE demand for tank cars has again become acute and, late in November, the A.A.R. Mechanical Division, issued a circular letter urging more prompt and adequate repairs. On December 1, a second appeal was issued emphasizing the importance of handling promptly the disposition of tank cars held out of service awaiting advice of car owner as to disposition. It was recommended that petroleum-loaded tank cars which cannot be made satisfactorily serviceable due to required general or extensive repairs be held at the point found in bad order, and the car owner advised by wire or telephone of the condition of the car and the disposition requested. The owner is requested to arrange for repairs at his own or contract repair shop and advise the carrier holding car by wire within 48 hr.

The necessity of ordering materials from car owners by wire or telephone and making shipments without delay via express or truck was also stressed and full co-operation and compliance with the suggestions and instructions was strongly urged in order to expedite the movement of petroleum products during the present emergency.

#### THE CONDITION OF EQUIPMENT FURNISHED FOR LOADING

Under date of November 20, the A.A.R. worded circular letter dealing with proper loading of cars and selection of proper cars for loading. Cars are apparently continuing to arrive at terminals under load and in unserviceable condition which require repair and in many cases transfer of the lading. Predominating defects on such cars are defective floors and floor stringers, body bolsters broken and corroded, center sills broken and bent or defective, side sills broken, bent or weak and cross bearers broken and corroded.

The Mechanical Division again urges that this matter be handled with all concerned and that every effort be made to insure that cars placed for loading are in proper condition to carry their lading to destination without the necessity of intermediate shopping or transfer.

#### STANDARD A.A.R., PASSENGER-CAR AXLE ADOPTED

On September 18, the A. A. R. Mechanical Division sent out to member roads its recommendations for standard dimensions (Continued on second left-hand page)

#### Orders and Inquiries for New Equipment Placed Since the Closing of the February Issue LOCOMOTIVE ORDERS

Road New York Central	No. of locos.	Type of loco. Builder 4-8-4
	FREIGHT-C	AR ORDERS
Road Chicago Great Western Chicago, Milwaukee, St. Paul & Pacific Colorado & Wyoming Denver & Rio Grande Western Fruit Growers Express Co. Illinois Terminal Missouri-Kansas-Texas New York Central	500° 500° 500° 300° 50° 300°	Builder Box Pullman-Standard 50-ton flat Co. shops Mill type gondolas Mt. Vernon Car Mfg. Co. 50-ton box Pressed Steel Car Co. 40-ton refrigerator Mt. Vernon Car Mfg. Co. 50-ton flat American Car & Fdry. Co. Auto-box Co. shops 70-ton gondolas Despatch Shops
	FREIGHT-CA	R INQUIRIES
Chicago, Rock Island & Pacific	500	Box
1	PASSENGER-C	AR INQUIRIES
		Type of car Builder Passenger

¹ These engines, which are for delivery this year, will be substantially the same as the experimental 4-8-4 type locomotive now being built for the railroad by the American Locomotive Company. The principal difference is in the use of a modified trailer truck, which will permit a further increase in ash-pan volume. The new locomotives will have extra large tenders designed to carry 46 tons of coal and 18,000 gal. of water.

<sup>8</sup> Authorization unconfirmed.

<sup>8</sup> For fourth quarter delivery.

<sup>4</sup> W. P. B. authorization received. M. S. Sloan, president, says the cars will be built in cooperation with the Office of Defense Transportation as the company's share of the 20,000 box cars that the railroads have been requested to purchase and place in service as soon as possible to take care of military demands. The cars will be constructed in the railroad's own shops at Denison, Tex., where 6,000 new and rebuilt cars are reported to have been turned out during the last four years. years.

For Pittsburgh & Lake Erie.

Inquiry unconfirmed.



When heavy boiler repairs are required, additional evaporating and superheating surfaces can be obtained with small flues and type E superheaters.

With the increase in Boiler Horsepower resulting from this combination, older locomotives can maintain the pace set for heavier loads and faster schedules.



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AMERICAN THROTTLES • STEAM DRYERS
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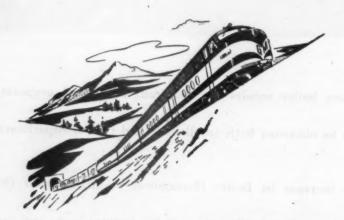
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g ir IT'S A GREAT NEW DAY FOR RAILROADING

# HOW DURABLE IS A DIESEL?



GENERAL OTORS
LOCO OTIVES

## IT'S A GREAT NEW DAY FOR RAILROADING

All General Motors Diesel locomotives
ever built and put in freight, passenger runs,
or switching service, excepting the few
destroyed in wrecks, during the past ten
years are still going strong.

In fact, many of these Diesels are actually better than when built due to improvements that have been made in certain service and replacement parts.

So it's pretty hard to say how durable these General Motors locomotives are since they bid fair to continue indefinitely. And, up to date, there are upwards of 1,800 units of them on 83 of America's major railroads and in heavy industries.

ON TO FINAL VICTORY \* BUY MORE WAR BONDS

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION
LA GRANGE, ILL.

for A. A. R. passenger-car axles when used with roller bearings, also for axle-centering dimensions. This axle is not a new design but is the standard A. A. R. passenger-car axle with ends modified to accommodate all four types of roller bearings, namely, Hyatt, SKF, Fafnir and Timken. As a result of favorable letterballot action, the revised journal dimensions for A. A. R. passenger-car axles when used with roller bearings, also axlecentering dimensions for both plain and roller-bearing axles, have been adopted as standard and recommended practice.

#### M. B. M. A. 1944 Proceedings Now Available

THE 1944 Proceedings of the Master Boiler Makers' Association are now available through the secretary, A. F. Stiglmeier, 29 Parkwood street, Albany, N. Y.

#### Duer Receives Stevens Honor Award

JOHN V. B. DUER, assistant to vice-president of the Pennsylvania, was one of nine leading engineers and industrialists to receive a newly established honor award for "notable achievements," at the dinner observing the 75th anniversary of the granting of the charter to Stevens Institute of Technology, held in New York, February 15. Mr. Duer was cited for his accomplishments "in the engineering field of rail-road electrification."

#### Ton-Miles in 1944 1.4 Per Cent Above 1943

AGAIN in 1944 the railroads handled the greatest volume of freight traffic, measured in ton-miles of revenue freight, for any year on record, according to the Association of American Railroads. In that year it amounted to approximately 737,000,-000,000 revenue ton-miles, according to preliminary estimates based on reports received from Class I roads. This was an increase of 1.4 per cent above the previous record established in 1943, when the volume amounted to 727,075,495,000 revenue ton-miles. The volume of freight traffic carried by the railroads in 1944 was an increase of 121 per cent compared with 1939.

The volume of freight traffic handled in December, 1944, alone amounted to 57,000,000,000 revenue ton-miles, a decrease of 6 per cent compared with December, 1943.

#### 1944 Equipment Installations

CLASS I railroads put 40,392 freight cars and 938 locomotives in service in 1944, according to the Association of American Railroads. This was an increase of 11,684 cars and an increase of 165 locomotives compared with the number installed in 1943. In 1942 the railroads put 63,009 new freight cars and 712 new locomotives in service.

Of the new freight cars installed in 1944, there were 14,476 plain box, 3,132 automobile, 4,065 gondolas, 16,656 hopper, 1,319 flat, 482 refrigerator, 261 stock cars and one other type of car. The new locomotives installed in 1944 included 329 steam, one electric, and 608 Diesel-electric, compared with 429 steam, 15 electric, and 329 Diesel-electric in 1943.

#### Distribution of Horsepower of Total Diesel Locomotives in Railway Service

' (As estimated by the Railway Age)

Fr				Pass. t. locomotives	Totals		
Horsepower 5,400 4,050 3,600 2,700 2,700 1,800 1,200 1,000 600 380 Less than 380	. 6	Total hp. 1,031,400 4,050 16,200 9,000 600 3,040 500	No. 11 1 2 8 220 31 7 7 7	Total hp. 59,400 4,050 7,200 21,600 440,000 55,800 8,400 7,000	No. 202 2 2 14 220 31 7 166 1 8 2	Total 1,090,800 8,100 7,280 37,800 440,000 55,800 8,400 16,000 3,040 500	
Total road locos	. 218	1,064,790 (Averaging 8	287 00 hp. per	603,450 locomotive)	505 2,010	1,668,240 1,610,438	
Total road and switch locos	1		- 70		2,515	3,278,678	

Note:—384 Diesel locomotives of 268,840 total horsepower are estimated to be in service on switching and terminal companies and on Class II and III railroads.

Class I railroads on January 1, 1945, had 36,597 new freight cars on order. On the same date last year they had 35,737 on order. The former figures included 19,210 plain box, 1,376 automobile box, 4,074 gondolas, 8,915 hoppers, 2,183 refrigerator, 239 stock, and 600 flat cars.

#### Miscellaneous Publications

"CRUCIBLE MELTERS' HANDBOOK."—Crucible Manufacturers' Association, 90 West street, New York 6. An 18-page pamphlet, illustrated. A treatise on crucible furnaces and on the storing, handling, and use of crucibles. Shows actual installations and contains a table of standard sizes of crucibles and their dimensions; a table of melting points of various metals; a table of the composition of steam or red brass alloys, and a tabulation of the approximate composition and physical properties of aluminum sand casting alloys.

"METAL QUALITY."—Drop Forging Association, 605 Hanna Building, Cleveland, Ohio. Forty-page booklet. Describes and illustrates how "hot working" improves properties of metal. Deals broadly with characteristics of forging materials and, by means of halftone illustrations and diagrams, gives in not-too-technical language an understanding of how steel gains in strength and toughness, step by step, progressively through hot-working operations, from ingot to finished forging. The booklet then shows how "forging quality" steel is still further improved by hot-working.

"Shot Peening and the Fatigue of Metals." By H. F. Moore, published by American Foundry Equipment Company, 555 South Byrkit street, Mishawaka, Ind. Twenty-four-page booklet. Contains an interpretation and analysis of many month's laboratory research on the subject of shot peening and the fatigue of metals. Covers types of structural damage of metals; how shot peening increases resistance to plastic distortion; the origin of fatigue cracks; the effects of cold working; measurement of shot peening intensity; examples of increased fatigue life from shot peening, etc. Illustrated with microphotographs, charts and tables.

Railroads also had 468 locomotives on order on January 1, this year, which included 66 steam, two electric, and 400 Diesel-electric locomotives. On January 1, 1944, they had 955 locomotives on order which included 339 steam and three electric and 613 Diesel-electric.

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#### Parmelee Succeeds Gormley in War Manpower Job

Dr. Julius H. Parmelee, director of the Bureau of Railway Economics, has been appointed an alternate management member of the War Manpower Commission's Management-Labor Policy Committee. He will serve as alternate for R. Conrad Cooper, assistant vice-president of the Wheeling Steel Corporation, succeeding M. J. Gormley, executive assistant of the Association of American Railroads, who retired on December 31.

#### Material Handling Institute

LAWRENCE J. KLINE, of the Mercury Manufacturing Company, Chicago, has been elected president of the newly formed Material Handling Institute. J. Faulkner Thomas of the Thomas Truck & Caster Co., Keokuk, Iowa, has been elected vice-president and Walter S. McCann, acting secretary and treasurer. The institute is a non-profit organization designed to serve as a medium for the exchange of facts and information relating to industrial material handling and the activities of manufacturers in that field.

#### Eastern Car Foremen Elect Officers for 1945

At the annual meeting of the Eastern Car Foremen's Association, held on January 12 in the Engineering Societies building, 29 West Thirty-ninth street, New York, the following officers were elected for the coming year: President, K. H. Carpenter (superintendent car department, Delaware, Lackawanna & Western); first vice-president, G. H. Massy (superintendent, motive power, Central of New Jersey); second vice-president, P. J. Hogan (superintendent car inspection and maintenance New York, New Haven & Hartford); treasurer, T. G. Case (general car foreman, New York Central), and secretary, Wilson P. Dizard (American Car and Foundry Company).

#### Supply Trade Notes

Ohio Brass Company.—The San Francisco, Calif., office of the Ohio Brass Company, Mansfield, Ohio, has been moved to 582 Market street.

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STANDARD RAILWAY EQUIPMENT COMPANY.—Arthur A. Frank, president of the Standard Railway Equipment Company, Chicago, has been elected chairman of the board and will continue as president of the Standard Railway Equipment Manufacturing Company. A. A. Helwig, vice-president of the Standard Railway Equipment Company, at Chicago, has been elected president to succeed Mr. Frank. D. R. Arnold, vice-president of the Standard Railway Equipment Company, at New York, has been appointed senior vice-president at New York, and R. G. Sonquist and J. E. Vaughn, assistant vice-presidents, at New York and Chicago, respectively, have been named vice-presidents.

ELECTRIC STORAGE BATTERY COMPANY .-Lester E. Lighton, manager of the department of development and design of the Electric Storage Battery Company, Philadelphia. Pa., has been elected vice-president in charge of engineering. Mr. Lighton is a graduate of Bucknell University (1920). He began his career on the sales staff of the Electric Storage Battery Company at Detroit, Mich., in that year and became manager of automotive manufacturers sales, with headquarters in Philadelphia, in 1925. He was assigned to the department of development and design as assistant to the manager in 1935 and was appointed manager of that department in 1940.

GENERAL RAILWAY SIGNAL COMPANY .-Sidney George Johnson, vice-president in charge of sales of the General Railway Signal Company, with headquarters in New York, has retired at his own request from active charge of sales. Winthrop K. Howe, vice-president in charge of engineering, with offices at Rochester, N. Y., has retired, after 44 years of service with the company, but will continue in an advisory capacity. Herbert W. Chamberlain, assistant to the president, with offices in New York, has been appointed vice-president in charge of sales. Charles S. Bushnell, train-control engineer, has been promoted to the position of chief engineer. Percy W. Smith, sales engineer, reporting to the New York office, has been appointed resident manager of the New York office. Wilbur D. Cloud, resident manager of the New York office, has been appointed eastern manager. Arthur S. Heimbach, sales engineer in the Chicago office, has been appointed resident manager of the Chicago office. William H. Bennett, resident engineer at San Francisco, has been appointed sales engineer with headquarters in New York. Oscar S. Field. senior designing engineer, with offices at Rochester, N. Y., has been appointed director of engineering and research.

NATIONAL LOCK WASHER COMPANY .-Esty Foster, executive vice-president, has been elected president and a director of the National Lock Washer Company, Newark, N. J., to succeed Cyrus H. Loutrel, who has become chairman of the board, a newly created office. Mr. Foster joined the company as executive vice-president in May, 1944, from Ford, Bacon & Davis, Inc., engineers, of New York. For three years he had served in Washington on leave of absence as operations adviser and in other positions with the Office of Production Management, the War Production Board, and the combined Production and Resources Board. He was formerly a member of the faculty of the Graduate School of Business Administration, Harvard University, and a special engineer in the office of the assistant to the president and of the inspecting engineer of the New York Central. Arthur W. Preikschat and Gilbert E. Webster, vice-presidents, have been elected directors of the company.

CINCINNATI MILLING AND GRINDING MA-CHINES, INC.—Customers of the Cincinnati Milling Machine Company and Cincinnati Grinders Incorporated in the Baltimore, Md., and Washington, D. C., territories are now being served through their sales subsidiary, Cincinnati Milling and Grinding Machines, Inc., located at Fifteenth and New York avenues, N. W., Washington, D. C. E. Reiniger, factory specialist, is now associated with C. W. Burgess who is located in the Washington office. Reiniger also continues to serve the Philadelphia, Pa., territory of the W. E. Shipley Machinery Company. Clarence A. Thumm, who was previously the company's agent in the Baltimore and Washington areas, has retired.

AMERICAN ROLLING MILL COMPANY-Roy P. Tooke, of the general engineering staff of the American Rolling Mill Company, has been appointed assistant chief engineer of the company's general engineering division. In the sheet and strip sales department, the following promotions have been announced. Murray B. Wilson, formerly New York district sales manager, has been appointed Dayton, Ohio, district sales manager to succeed Edson D. Dronberger. W. B. Quail, formerly New York district manager of the American Rolling Mill Railroad Sales Company, succeeds Mr. Wilson as New York district manager of sheet and strip sales. Mitchell G. Duncan, who has been connected with the company's St. Louis, Mo., office for the past 12 years, has been transferred to the Detroit, Mich., office as a salesman and Fred Mayhew, of the company's home sales office and a former member of the St. Louis office, succeeds Mr. Duncan at St. Louis. Robert L. Wells, Jr., a salesman in the Minneapolis, Minn., office, has been transferred to the Dallas, Tex., office.

AMERICAN WELDING & MANUFACTURING Co.—Edward C. Fales, assistant to the president of the American Welding & Manufacturing Co., Warren, Ohio, has been elected vice-president of the company.

METAL & THERMIT CORPORATION.—John B. Tinnon, vice-president in charge of sales and Walton S. Smith, vice-president in charge of production, have been elected to the board of directors of the Metal & Thermit Corporation.

Crane Company.—R. E. Penny, manager of the Jacksonville, Fla., branch of the Crane Company, has been appointed manager at Los Angeles, Cal., to succeed D. D. Updegraff, who has resigned. L. R. Bauer, manager at Brooklyn, N. Y., and New Haven, Conn., succeeds Mr. Penny at Jacksonville, and J. J. Murray, a planning department analyst at the Chicago works, has been appointed manager at New Haven. O. F. Woodyard, former manager at Little Rock, Ark., has been appointed manager in Memphis, Tenn., to succeed F. A. Duncan, who has retired, and A. C. Gribble, a salesman at the Houston, Tex., branch, has been appointed manager at Little Rock.

PULLMAN-STANDARD CAR MANUFACTURING COMPANY.—A several-million dollar modernization and construction program to prepare its plants for the speedy production of railway equipment, including newly designed car's embodying revolutionary concepts of passenger accommodations, has been announced by the Pullman-Standard Car Manufacturing Company.

The program, as revealed by Wallace N. Barker, vice-president, embraces all six of the company's plants and includes new construction, installation of new equipment, renovations of buildings and machinery, alterations for improving working conditions and rearrangement of facilities for the most efficient operation. The Chicago and Worcester, Mass., plants will be revamped for the resumption of passenger-car construction, with the latter also scheduled for additional changes and new machinery for the better manufacture of modern transit equipment.

The company's four freight car plants in Hammond, Ind., and Michigan City, Butler, Pa., and Bessemer, Ala., presently occupied with war contracts for mortars, heavy artillery, shells and freight cars for the domestic railroads and for the Army are scheduled for alterations to expedite ultimate production of domestic and foreign freight cars.

To help provide employment the company is prepared, as soon as it gets the green light, to produce wholly new types of cars that are expected to aid the railroads in retaining a substantial part of their heavy wartime passenger traffic by raising travel comfort to new heights.

# LOCOMOTIVES THAT ARE MAKING

HISTORY



Ten of the powerful, high-speed 4-8-4's have just been delivered by American Locomotive to the Union Pacific.

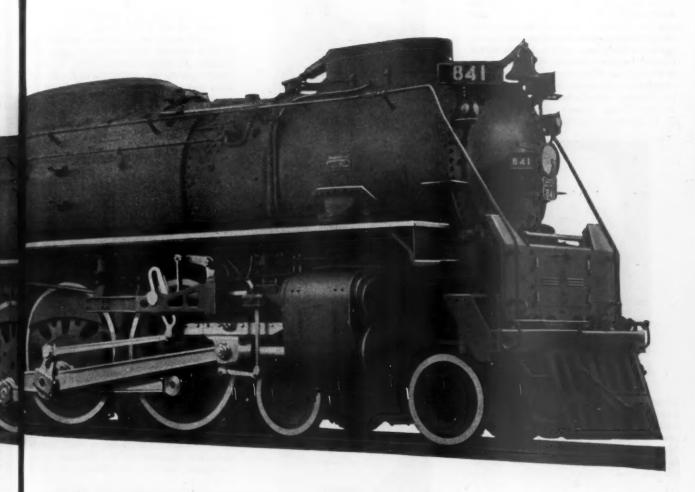
Forty-five of these locomotives are now operating on fast passenger schedules, pulling 16 to 22 car trains to their destinations, on time.

The first of these 4-8-4's was delivered in 1937. Since that time, these passenger locomotives have, through their successful operation, become part of Union Pacific's locomotive backbone.

#### Here are the "SPECS":

Weight on Drivers			270,300 lbs.
Weight of Engine			490,700 lbs.
Cylinders			25 x 32 ins.
Diameter of Drivers	5		80 ins.
Boiler Pressure .			300 lbs.
Tractive Power .			. 63,800 lbs.
Capacity (Water)			23,500 gals.
			25 tons

Locomotive designs developed by American Locomotive Company have been, are, and will continue to be powerful factors in American railroad operating efficiency and economy.



Unsurpassed for the Job because Built for the Job



American Locomotive

NEW YORK

OKONITE COMPANY .- A. L. McNeill has been appointed manager, Chicago district, of the Okonite Company and will direct the company's insulated wire and cable sales in the middle western territory extending from Ohio to the Rocky Mountains. Mr. McNeill was previously manager of the railroad department in that territory. He began his career with the Alton in 1900 and from 1908 to 1911 was chief clerk in the purchasing department. Following the temporary consolidation of the Alton, the Minneapolis & St. Louis, the Iowa Central and the Toledo, St. Louis & Western, Mr. McNeill was appointed assistant purchasing agent for this group in 1911. He joined the Central Electric Company, Okonite's agent in Chicago, in 1913 and served as manager of railroad sales until 1925 when he joined the Okonite organization which established its own Chicago district office at that time. E. H. McNeill, formerly manager of the

A. L. McNeill

power and light department, has been appointed assistant manager, Chicago district, and *Harry D. Pierce* has been appointed office sales manager. Both A. L. McNeill and E. H. McNeill will continue to work with the railroads and public utilities.

AIR REDUCTION SALES COMPANY .- H. F. Henriques, formerly sales manager of the north central division, has been appointed general sales manager of the Air Reduction Company. J. J. Lincoln, formerly sales manager of the south central division, has been appointed director of sales services. C. M. Bloodgood, sales manager of the Pacific Coast division, has been appointed assistant to the vice-president in charge of sales. All have headquarters at the company's New York offices. H. P. Etter, manager of the Los Angeles, Calif., district, has been appointed sales manager of the Pacific Coast division with headquarters in San Francisco, Calif.

AMERICAN CAR AND FOUNDRY COMPANY, —W. E. Olds has been appointed sales agent for the American Car and Foundry Company, with headquarters in the company's Chicago office. Mr. Olds is a graduate of Wisconsin University (1923). He served overseas for 16 months with the U. S. Engineers' Corps in the first World War. He joined the Gary, Ind., works of

the U. S. Steel Corporation in 1923 and was employed in that company's St. Paul, Minn., sales office in 1924-25. He subsequently worked in the investment field until 1936. Since then he has served successively as sales engineer for the Petti-



W. E. Olds

bone, Mulliken Corporation and the Gustin-Bacon Manufacturing Company, and, until recently, as western manager, railway division, for the Elastic Stop Nut Corporation.

GENERAL ELECTRIC COMPANY.—F. H. Craton has been appointed assistant manager of the General Electric Company's



F. H. Craton

transportation division. For the present he will continue also as manager of the industrial haulage division. Mr. Craton is a graduate of Syracuse University. He joined the General Electric Company's factory management course in Schenectady,

#### Army-Navy E Awards

American Steel & Wire Company, Worcester, Mass. Third renewal. Automatic Transportation Company, Chicago. Fourth award. Briggs Clarifier Company, Washington, D. C. Third award.

Chain Belt Company, Milwaukee, Wis. Fourth award.

General Cable Corporation, Rome, N. Y. Fourth award.

N. Y., in 1924; entered the railway equipment engineering division at the Erie, Pa., works in 1926; was transferred to the transportation engineering division in 1930, and was appointed manager of the industrial haulage division in August, 1941. Mr. Craton has served in an executive capacity on the War Production Board and is now chairman of the mining and industrial locomotive section of the National Electrical Manufacturing Association.

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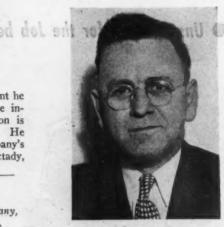
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Cooper-Bessemer Corporation.—A. M. Buxton, of the Tulsa, Okla., office of the Cooper-Bessemer Corporation, has been appointed assistant sales manager, with head-quarters at Mount Vernon, Ohio. In addition to sharing responsibilities of the general sales manager, Mr. Buxton will direct the company's oil and gas field sales.

United States Steel Corporation.—
The corporation plans to spend at least \$50,000,000 in post-war improvements to its Gary, Ind., mills, Irving S. Olds, chairman, has disclosed. This program, he said, embraces improvements and additions to raw material-handling equipment, renovation of blast furnaces and machinery, improvements to facilities for the manufacture of wheels and axles, an enlargement of the sheet and tin mill and a rebuilding and modernization of the bridge and structural steel fabricating plant.

Paxton Diesel Engineering Company.

—George T. Badger has been appointed chief sales engineer of the Paxton Diesel Engineering Company, a newly formed subsidiary of the Paxton-Mitchell Company at Omaha, Neb., according to an announcement by James L. Paxton, Jr., president of both companies. Mr. Badger is an engineering graduate of Purdue University. He comes to his new position after 13 years with the Minneapolis-Honeywell Regulator Company. For the past five years he had been sales engineer in charge of railway controls market development and previously was manager of the company's Indianapolis branch. Mr. Badger, as chief



George T. Badger

sales engineer, will direct market development of Diesel specialties and parts manufactured by the Paxton Diesel Engineering Company. The company will also maintain a Diesel repair service for railroads and other operators of Diesel engines.

INDEPENDENT PNEUMATIC TOOL COM-PANY.—W. H. Brewer, general manager of the Aurora, Ill., factory of the Independent Pneumatic Tool Company, has retired after 36 years of service in the plant.

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Spring Packing Corporation.—John D. Herr has been elected vice-president of the Spring Packing Corporation, Chicago. Mr. Herr was born in Altoona, Pa., and, after serving the Pennsylvania in various capacities, entered the employ of the Spring Packing Corporation in 1922.

NATIONAL BATTERY COMPANY.—Effective March 1, 1945, H. G. Barnes will succeed Herbert King as vice-president in charge of sales of the National Battery Company and its Gould Commercial Division. Mr. Barnes has been associated with the National Battery Company since 1940, when he was appointed vice-president and general manager of National's Gould Com-



H. G. Barnes

mercial Division with headquarters at Depew, N. Y. Prior to his present connection, Mr. Barnes was president of the Motor Power Equipment Company, St. Paul, Minn. In his new capacity he will make his headquarters at the general offices in St. Paul. Mr. King, whose connection with National Battery Company dates from 1933, plans to enter business in San Francisco.

KENNAMETAL, INC.—Robert B. Thomson has been appointed tool engineer of Kennametal, Inc., with headquarters at Latrobe, Pa. Mr. Thomson will be assistant to the chief engineer and will be responsible for subcontracting.

AMERICAN HOIST & DERRICK COMPANY.

—Frederic Crosby, president of the American Hoist & Derrick Co., St. Paul, Minn., has been elected chairman of the board and has been succeeded by Harold O. Washburn, vice-president and treasurer. R. E. Ljungkull, chief engineer; has been elected vice-president of engineering; D. B. Botkin, superintendent of production, has been elected vice-president of manufacturing; and S. M. Hunter, manager of sales, has been elected vice-president of sales. J. F. Bishop has been named secretary and assistant treasurer and R. J. Henry has been appointed assistant secretary.

COPPERWELD STEEL COMPANY.—Clyde S. Sowards has returned to the Copperweld Steel Company, Glassport, Pa., after a 2½ year leave of absence during which he served in the U. S. Army, holding the rank of captain at the time he reverted to an inactive status. He will take up his former territory for Copperweld, the northern portion of the South Atlantic states.

GRIFFIN WHEEL COMPANY.—Charles E. Barnes, sales agent of the Griffin Wheel Company, Chicago, has been appointed gen-



Charles E. Barnes

eral sales manager and Edward Q. Sylvester, sales engineer at Boston, Mass., has been appointed assistant to the president. Both will have headquarters at Chicago. Charles E. Barnes entered the employ of the Griffin Wheel Company in 1937 and from 1939 to 1943 served as sales agent at Kansas City, Mo. In the latter year, he was transferred to the general sales department at Chicago.

Edward Q. Sylvester entered the employ



Edward Q. Sylvester

of the company in 1940 as sales engineer at Boston.

#### Obituary

CHARLES S. KNAPP, engineer of valuation of the Pullman Company, died on January 30. Mr. Knapp was a graduate of the Washington University of St. Louis, Mo. He entered railway service in 1898 as a draftsman of the Pullman Company at Chicago. He left the company in 1901 and returned two years later as a mechanical

inspector. In 1905 Mr. Knapp was appointed assistant mechanical superintendent, with headquarters at Chicago; in 1914, engineer of tests; in 1916, assistant chief engineer, and on January 1, 1921, engineer of valuation.

GURDEN H. HAMILTON, vice-president of the Glidden Company, died of a heart attack on February 7 while attending a company meeting in Cleveland, Ohio.

JOHN F. SHANAHAN, of the New York sales department of the Superheater Company, died January 26. Mr. Shanahan, whowas 59 years of age, received his railroad training in the motive-power department of the Erie. He joined the New York sales and service departments of the Superheater Company in April, 1917.

ROBERT F. CARR, chairman of the board of the Dearborn Chemical Company, Chicago, died in Passavant Hospital, Chicago, on January 22 after an illness of three weeks. At the time of his death Mr. Carr was a director of several other companies



Robert F. Carr

in Chicago including Wilson & Co., the Continental Illinois Bank & Trust Co., the Peoples Gas Light & Coke Co., and the Chicago & Eastern Illinois. Mr. Carr was born at Argenta, Ill., on November 21, 1871, and was a graduate of the University of Illinois in 1893. In the following year he entered the employ of the Dearborn Chemical Company and served successively as secretary and vice-president and general manager until 1907 when he was elected president. In January, 1944, he was elected chairman of the board. During World War I he was a major on the general staff of the Purchase, Storage and Traffic division of the U. S. Army.

Frank L. Gibbons, manager of sales of the alloy division of the Carnegie-Illinois Steel Corporation, Chicago, died in Winnetka, Ill., on January 19. Mr. Gibbons had been associated with Carnegie-Illinois since February 1, 1936. Previously he had been vice-president of the Timken Company, Canton, Ohio, and before that was with the Republic Steel Corporation, Cleveland. Mr. Gibbons was 53 years of age. He was educated at the Carnegie Institute of Technology.



on train communication

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#### **DEPENDABLE** voice communication

"Union" I.T.C. (Inductive Train Communication) system provides dependable, practicable two-way voice communication between vehicles of a train, between trains, and between trains and wayside points.

It is a train communication system designed exclusively for railroad use, by men who know railroad needs, and proved through years of regular railroad service.

### Built to mind your own business

The messages concerning the operation of your railroad are your own business.

With mail, telegraph and ordinary telephone, an essential degree of privacy is realized, and messages handled over a train communication system should be equally restricted to your own organization. You don't want them to be picked up by other roads, nor do other roads want to receive them.

This is easy to prevent with "Union"

Inductive Train Communication.

When you use "Union" I.T.C. your messages follow your right of way. They go where you want them to go.

Suitable selection of carrier frequencies avoids interferences with other communication systems, or with "Union" I.T.C. systems on parallel or intersecting roads.

That's one more reason why, for dependable train communication, "Union" I.T.C. is the answer.

#### UNION SWITCH & SIGNAL COMPANY

SWISSVALE

NEW YORK

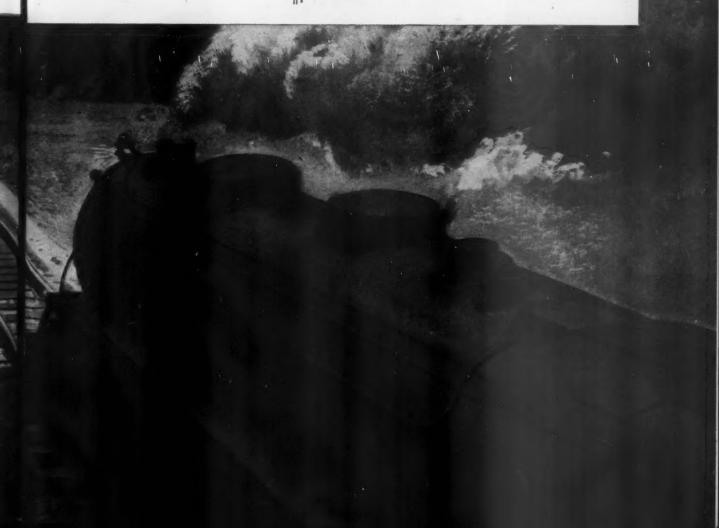
CHICAGO



PENNSYLVANIA

ST. LOUIS

SAN FRANCISCO



#### **Personal Mention**

#### General

GEORGE H. POLLARD has been appointed mechanical engineer of the Missouri Pacific, with headquarters at Palestine, Tex.

A. O. GEERTZ has been appointed fuel engineer of the Pennsylvania, with headquarters at Philadelphia, Pa.

C. B. Corron, supervisor of motor-car equipment of the Chicago & Northwestern at Chicago, has retired.

K. F. Nystrom, mechanical assistant, chief operating officer, of the Chicago, Milwaukee, St. Paul & Pacific, with head-quarters at Milwaukee, Wis., has been named chief mechanical officer. This is a change of title.

FLOYD R. MAYS has retired as vice-president of the Illinois Central, with headquarters at Chicago. Mr. Mays was born at Crockett, Va., on August 28, 1879, and entered railway service at the age of 15 years as a machinist apprentice on the Norfolk & Western. He subsequently became a machinist and as such served on the Southern at Salisbury, N. C., and Selma, Ala. On July 31, 1901, he became a machinist on the Yazoo & Mississippi Val-



Floyd R. Mays

ley (now part of the Illinois Central) at Memphis, Tenn., and from October, 1901, to 1917 served successively as locomotive fireman, locomotive engineman, instructor on transportation rules, traveling engineer, assistant trainmaster and trainmaster. On August 15, 1917, he was appointed superintendent of the New Orleans division, with headquarters at Vicksburg, Miss.; on April 1, 1923, he was transferred to the Ilinois division of the Illinois Central, with headquarters at Champaign, Ill.; on January 1, 1926, became general superintendent of the Y. & M. V., with headquarters at Memphis, and on October 1, 1929, was appointed general superintendent of motive power of the I. C., with headquarters at Chicago. His title was later changed to general superintendent of equipment. In April, 1939, he became general manager, and on January 1, 1940, was elected vice-president.

HARVEY C. GRIFFITH, electrical engineer of the Pennsylvania at Philadelphia, Pa., has been appointed assistant chief engineer—traction, communications, signals—with headquarters at Philadelphia. Mr. Griffith was born at New Enterprise, Pa., on June 17, 1890, and received his degree in elec-



Harvey C. Griffith

trical engineering from Lehigh University in 1914. He entered the service of the Pennsylvania in February, 1915, as a draftsman in the office of the electrical engineer at Altoona, Pa., and was transferred to Philadelphia in 1916, working in various capacities on the Paoli and

Chestnut Hill electrifications. In 1923 Mr. Griffith was furloughed to Gibbs & Hill, consulting engineers, to serve as construction superintendent during the installation of substations and lines for power supply to the West Jersey & Seashore (now the Pennsylvania-Reading Seashore Lines), and the closing down of a company-owned power plant at Westville, N. J. Upon completion of this work he returned to the electrical engineer's office of the Pennsylvania as foreman. On May 1, 1927, he was appointed assistant engineer, with the special assignment of preparing an electrification study for the eastern territory of the Pennsylvania. When this work was completed he again returned to the electrical engineer's office, becoming assistant electrical engineer in May, 1929, and actively engaging in the New York-Washington electrification project. On July 1, 1935, Mr. Griffith was appointed electrical engineer at Philadelphia.

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Dr. William M. Barr, chief chemical and metallurgical engineer of the Union Pacific at Omaha, Neb., has been appointed research and standards consultant, with headquarters at Omaha. Dr. Barr was born at West Union, Iowa, on August 26, 1878, and is a graduate of the University of Iowa (1902). He also attended Grinnell College and the University of Penn-



Dr. William M. Barr

sylvania, from the latter of which he received the degree of Doctor of Philosophy in 1908. Dr. Barr first entered railway service in May, 1916, as a consulting chemist in the employ of the Union Pacific, later becoming chief chemist and metallurgical engineer.

J. J. Daly, master mechanic of the Nebraska division of the Union Pacific at Council Bluffs, Iowa, has been appointed superintendent of motive power and machinery, with headquarters at Omaha, Neb.

D. S. NEUHART, superintendent of motive power and machinery, eastern district, of the Union Pacific at Omaha, Neb., has been appointed assistant general superintendent of motive power and machinery, with head-quarters at Omaha. This is a newly created position.

#### Military Citations and Awards

LEGION OF MERIT

Lt. Col. Howard G. Hill, Port Arthur, Tex. Former mechanical engineer, Southern Pacific. For the performance of "outstanding services in southern Sicily where, from August 1 to August 18, 1943, he was general manager of the U. S. Military Railway.

BRONZE STAR MEDAL

Lt. Col. Miles G. Stevens, Somerset, Ky. Formerly master mechanic, Southern. For "meritorious service in connection with military operations during the period from December, 1943, to July, 1944." Reported by headquarters, European Theater of Operations.

ORDINE DELLA CORONA D'ITALIA

(Conferred by the Italian government "in appreciation of their services in the rehabilitation, reconstruction and operation of Italian State Railways.")

Brig. Gen. Carl R. Gray, Jr., Director General, First Military Railway Service. Grand Ufficiale Class.

Col. Frank R. Hosack, superintendent motive power, Missouri Pacific, St. Louis, Mo. Commendatore with Gold Crown.

Lt. Col. John J. Daugherty, former shop superintendent, Southern Pacific, Houston, Tex. Ufficiate with Silver Crown. M. W. McMahon has been appointed locomotive appliances inspector of the New York Central System with headquarters at New York.

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HARRY L. NANCARROW has been appointed general manager of the Eastern Region of the Pennsylvania, with headquarters at Philadelphia, Pa. Mr. Nancarrow was born at Jersey Shore, Pa., on January 13, 1897, and received his bachelor's degree in mechanical engineering from Bucknell University in 1920. He then entered railroading as a draftsman in the employ of the Pennsylvania at Harrisburg, Pa., and in 1921 was appointed a special apprentice at the Altoona works. After



Harry L. Nancarrow

serving briefly as a motive-power inspector at Altoona he became gang foreman at Cleveland, Ohio, in September, 1924, and assistant foreman in 1926. Mr. Nancarrow was appointed assistant master mechanie at Akron, Ohio, in March, 1927, and master mechanic of the Erie and Ashtabula division at New Castle, Pa., in May, 1928. He subsequently served as master mechanic on the Baltimore, Atlantic, Schuylkill, and Philadelphia Terminal didivision and in September, 1936, was appointed superintendent of the Logansport division at Logansport, Ind. He transferred to the Buffalo division in January, 1938; in May, 1939, was appointed superintendent, passenger transportation, eastern region, with headquarters at Philadelphia; January, 1940, became superintendent of the Pittsburgh division, and one year later was appointed general superintendent of the Lake division. On February 16, 1942, Mr. Nancarrow became general manager, western region, at Chicago, and is now general manager, eastern region.

JOSEPH A. ANDREUCETTI, who has been appointed chief electrical engineer of the Chicago & North Western with headquarters at Chicago, as noted in the February issue, is a past president of the Railway Electrical Pioneers Club; former secretary-treasurer of the Association of Railway Electrical Engineers, and is the present secretary of the Electrical Section, Mechanical Division, A. A. R. The statement regarding Mr. Andreucetti's connections with these associations was incorrect in the February issue.

J. R. Frohoff, master mechanic of the Colorado division of the Union Pacific at Denver, Colo., has been appointed superintendent of motive power and machinery of the northwestern district, with headquarters at Albina, Ore.

#### Master Mechanics and Road Foremen

HARRY GRAHAM DUGAN, who has been appointed master mechanic of the Toledo Terminal Railroad at Toledo, Ohio, as noted in the February issue, was born on August 31, 1894, at Jeffersonville, Ind. During high-school vacations he worked on ferry and excursion boats on the Ohio River. He completed his high-school education in 1913 and in November of that year entered the service of the Pennsylvania as a machinist apprentice. He became a machinist on April 1, 1916, subsequently serving as engine inspector, airbrake inspector, and assistant foreman. He was in Naval aviation during the first World War, from November, 1917, to September, 1919. Mr. Dugan then returned to the Pennsylvania as an engine inspector.



H. G. Dugan

He attended Purdue University from 1920 to 1924 and became a special apprentice in the employ of the New York, Chicago & St. Louis in 1924. He then served successively as enginehouse foreman, back shop foreman, and general back shop foreman, at Stony Island, Ill.; Bellevue, Ohio; Conneaut, Ohio; Buffalo, N. Y., and Lima, Ohio.

PORTER CLAY BRANCH, who has been appointed master mechanic of the Southern at Ludlow, Ky., as announced in the February issue, was born on October 17, 1896, at Shelby, Ala. From 1904 until 1911 he attended public school at Birmingham, Ala., and in September, 1913, became a drill press operator in the employ of the Southern at Birmingham. He was a machinist apprentice at Birmingham from December, 1913, until December, 1917, when he entered the service of the U. S. Army. He served overseas from July, 1918, until early in 1919. In February, 1919, he returned to the Southern as a machinist, leaving in June, 1919, to go with the St. Louis-San Francisco as a machinist at Birmingham. He returned to the Southern in December, 1922; became assistant enginehouse foreman on March 2, 1934; erecting shop foreman on June 16, 1938; general foreman at Princeton, Ind., on November



P. C. Branch

15, 1938; general foreman at Birmingham on March 16, 1942, and master mechanic at Ludlow on January 8, 1945.

#### Car Department

G. H. RUSHFORD has been appointed car foreman of the Michigan Central, with headquarters at Battle Creek, Mich.

L. F. ROZESKY, assistant supervisor, car repair of the Erie at Cleveland, Ohio, has been named chief A. A. R. inspector at Cleveland.

F. J. LARRISSEY, chief A. A. R. inspector of the Erie at Cleveland, Ohio, has been appointed chief shop inspector with headquarters at Cleveland.

#### Obituary

E. F. RICHARDSON, superintendent of motive power of the Bessemer & Lake Erie at Greenville, Pa., died there on February 3 after a brief illness. Mr. Richardson, who was 64 years old, was a native of Greenville, and had been employed in the mechanical department of the Bessemer & Lake Erie for 45 years.

JAMES E. McQuillen, who retired in February, 1943, as mechanical superintendent of the Gulf, Colorado & Santa Fe (part of the Atchison, Topeka & Santa Fe System) at Galveston, Tex., died in that city recently. Mr. McQuillen was born at Rochester, N. Y., on January 25, 1873, and attended the Sacred Heart Academy, Palestine, Tex. He entered railway service in October, 1887, with the International-Great Northern as an engine-house caller. He subsequently served as a machinist apprentice on the International-Great Northern and as machinist, foreman and general foreman in various railroad shops in the United States and Mexico until September, 1901, when he went with the G. C. & S. F. as a machinist at Temple, Tex. He later became enginehouse gang foreman; in December, 1902, general foreman at Gainesville, Tex.; in November 1906, master mechanic at Silsbee, Tex., and in August, 1913, mechanical superintendent, with headquarters at Cleburne, Tex. His headquarters were later transferred to Galveston.



## LUNKENHEIMER A. A. R. VALVES

MADE to A. A. R. specifications, but with inherent quality features of all Lunkenheimer products, these valves provide trouble free, dependable service for locomotives.

> Available in a variety of patterns, fullway and plug type, and with special connections for all requirements.

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Lunkenheimer offers a wide variety of products for locomotive and roundhouse service - valves of bronze, iron and steel; cocks,

> fittings, unions, air nozzles, boiler mountings and lubricating devices.



#### THE LUNKENHEIMER CO.

CINCINNATI, OHIO. U. S.A.

NEW YORK CHICAGO BOSTON PHILADELPHIA EXPORT DEPT, 318-322 HUDSON ST., NEW YORK

LUNKENHEIMER VALVES

### SUPERIOR 3-WAY FLUE ROLLER

The Superior 3-Way Flue Roller saves time and money — and does a better job. In less than a fourth of the time required by the old method it roll-expands the tube in the sheet, forms a prosser on the water side and flares the end of the tube ready for beading or welding. All this is accomplished by one operation with the results — even expansion, tight joint, correctly formed contours.

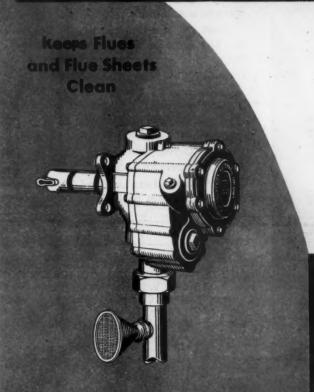
There is no distortion of flues, no fire cracking in the firebox end, no flying chips.

Write for full information

EXPANDS
PROSSERS
FLARES
AT ONE TIME

SAVES
80 PER CENT
IN TIME
AND LABOR

## SUPERIOR RAILWAY PRODUCTS CORP. 7501 Thomas Boulevard, Pittsburgh, Penna.



Longer hauls, heavier loads, more engine miles per month, less fuel consumption. Yes, the Superior Automatic Flue Blower means something to American railroads staggering under the tremendous war transportation demands of the nation. Let us send you performance charts showing how steam pressure was maintained over long continuous runs, and how "down time" was reduced to routine monthly inspections.

Dirty flues and flue sheets cause too much delay, too much waste of power, too much expense. Write today.

SUPERIOR

Automatic

FLUE BLOWER

# KEEP TRACKS CLEAR INSIDE YOUR EQUIPMENT!



#### DIESEL AVAILABILITY-

and Track-Tool Efficiency are both greatly increased with Quality Railroad Lubricants by SOCONY-VACUUM!

The cutaway at left spotlights the ring zone of a big Diesel. Here oil fights terrific pressures, and heat that shoots past 3500°F.

Gargoyle D.T.E. Oils (Nos. 1 to 5) resist these destructive forces, help keep rings free in their grooves, reduce cylinder and ring wear to a minimum.

These oils prevent hard-carbon deposits and any deposits that do form are soft and fluffy. Their strong protective film provides maximum lubricity.

These famous oils are also setting high performance records in large stationary and marine Diesels.

For your high-speed, automotive-type Diesels, Delvac 900 Series Oil gives this same high performance.

You'll keep Main Line and Maintenanceof-Way Diesels at peak efficiency with these proved oils.

SOCONY-VACUUM OIL COMPANY, INC. Standard Oil of N.Y. Division · White Star Division · Lubrite Division · Chicago Division · White Eagle Division · Wadhams Division · Magnolia Petroleum Company · General Petroleum Corporation of Calif.



#### COSTS HELD DOWN ON ROADWAY MAINTENANCE

Working in close cooperation with makers of maintenance-of-way equipment, Socony-Vacuum has developed special oils and greases that assure efficient, low-cost operation of all tools and their motors. On air-driven tools, above, Socony-Vacuum oils resist the washing action of water...protect vital parts against wear and rusting. Other quality lubricants are equally effective for air compressors and other equipment.



TRACTORS. Socony-Vacuum engine oils provide excellent protection against wear, help keep engines clean and contribute toward lower maintenance costs. Special chassis greases provide good lubrication, seal out grit, dirt, water from all fittings.



HEAVY EQUIPMENT. For railroad cranes and other heavy equipment your Socony-Vacuum Representative will gladly recommend lubricants that provide protection for engines, transmissions, heavy exposed gears.



IT PAYS TO KNOW WHAT'S NEW IN LUBRICATION

SOCONY-VACUUM
OIL COMPANY, INC.

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Complete Installations

HELP STEAM POWER
TO MEET the CHALLENGE

FLANNERY BOLT CO.

BRIDGEVILLE

PENNA



Insure longer life with smoother operation under most severe service, at less cost per mile

## Marquette Nitralloy BUSHINGS

LOCOMOTIVE SPRING GGING CONNECTIONS \* LOCOMOTIVE FOUNDATION BRAKE GEAR CONNECTIONS \* LOCOMOTIVE MOTION WORK CONNECTIONS \* SWING HANGER CONNECTIONS



# The METAL PRODUCTS CO.

HYDRAULIC GOVERNORS FOR DIESEL ENGINES . ROLLER BEARING TEXTILE SPINDLES . FUEL OIL PUMPS AIR COMPRESSORS . PRECISION PARTS AND ASSEMBLIES



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RAILWAY MECHANICAL ENGINEER

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Pump

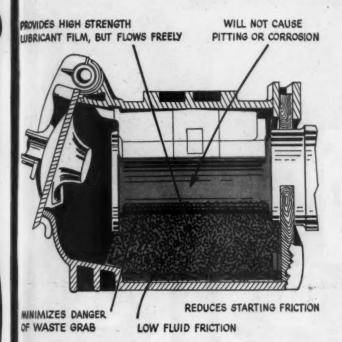
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#### STANDARD ENGINEERS NOTEBOOK

#### How to reduce journal friction



Available in a wide selection of types and viscosities, Calol Car and Engine Oils provide proper lubrication for oil-saturated-waste-packed car axle bearings operating in any temperature, load or speed condition found on railroads in the U.S.

All the oils in this group flow freely by capillary action, providing immediate lubrication on the operation of journals, and reduce starting and running friction.

Calol Car and Engine Oils may also be used for general free oiling - also for locomotive cross head guides, valve motion parts, shoes, wedges, etc.

There are 6 grades of Calol Car Oils. <u>Calol All</u>
<u>Year Car Oil</u> which fully meets A. A. R. specifications for all-year oils; Summer, #25, #35, #29X (compounded); Winter #14, #14X (compounded).

Calol RR Engine Oils are compounded and come in 3 grades: Winter, #10X, #14X; and Summer, #29X.

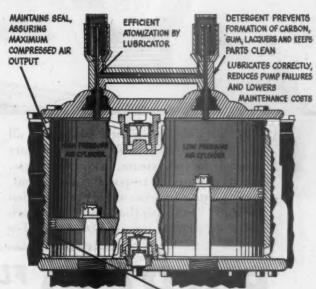
#### New oil ups air pump efficiency

The period between locomotive air-pump clean-ups may be extended considerably by using Calol Air Pump Lubricant instead of cylinder and valve oils.

In service where a 30-day clean-up period was normal with cylinder and valve oil in air pumps, these units were clean and generally in excellent condition, their rings free, after being operated on Calol Air Pump Lubricant for a much longer period.

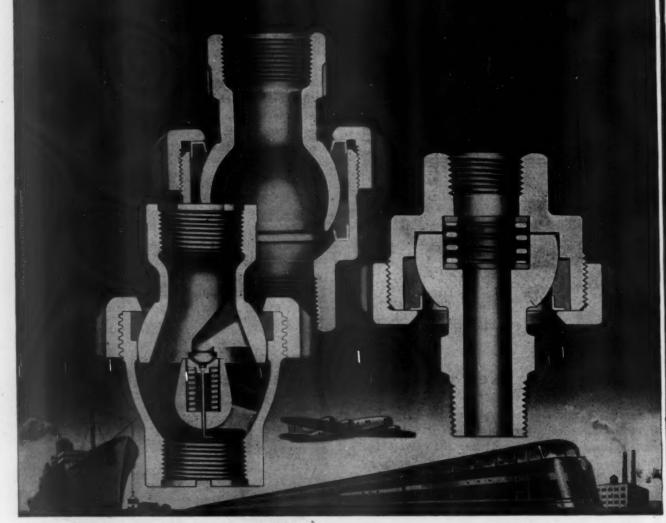
This compounded lubricant for locomotive air pump lubrication contains additives which give it excellent detergent properties and high stability in the presence of heat and air. These additives prevent formation of carbon, gum and lacquer in feed and triple valves, and remove deposits from pumps.

Because it maintains a tight seal between piston rings and cylinder walls and cools and lubricates completely, Calol Air Pump Lubricant helps New York and Westinghouse locomotive air pumps produce a maximum of compressed air.



RESISTS OXIDATION AND HIGH DISCHARGE TEMPERATURES

## FLEXIBLE FLUID CONVEYORS ABSORB VIBRATION-PROVIDE MOVEMENT



Barco Flexible Joints are serving in all industries where flexible conveyors are required for oil, steam, water, air, gas, etc. By means of responsive movement, Barco joints compensate for every motion—literally "roll with the punch" to absorb vibration, provide smooth movement. For

over 30 years, engineers and designers have found in Barco's wide range of designs the solution to their flexible joint problems. Consult our engineering department for detailed information. Barco Manufacturing Co., Not Inc., 1808 Winnemac Avenue, Chicago 40, Illinois.

In Canada: The Holden' Co., Ltd., Montreal, Canada

## BARCO FLEXIBLE JOINTS

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THE FREE ENTERPRISE SYSTEM IS THE SALVATION OF AMERICAN BUSINESS

"MOVE IN



Not just a swivel joint...but a combination of a swivel and ball joint with rotary motion and responsive movement through every angle.

DIRECTION"

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# CUPERHEAUNG 3 Coffin



The C-S Superheater's Welded Construction MEANS

Fewer Leaks, Less Maintenance Lower Upkeep Cost

THE J. S. COFFIN, JR., COMPANY ENGLEWOOD, NEW JERSEY

PLEASE SEND C-S SUPERHEATER BULLETIN

COMPANY.

ADDRESS



## Ten New Locomotives - TEN MILES OF B&W TUBING



One of the latest type locomotives built by the American Locomotive Company for freight and passenger service on the Rock Island.

In each of the Rock Island's ten latest 4-8-4 type combination freight and passenger locomotives are 199 boiler tubes and 58 flues, all 20 feet long over the tube sheets. Altogether they contain nearly ten miles of 21/4-in. and 51/2-in. tubing—and all of it was supplied by B&W. These modern motive power units thus join the long and steadily increasing list of B&W pressure tube installations in the railroad field.

More and more railroads, along with locomotive builders, are taking advantage of the COMPLETE service on boiler and mechanical tubing available at B&W. Reason is—B&W makes BOTH seamless and welded tubing. From this one source these users can therefore obtain either kind

for practically any motive power or shop requirement—and with full assurance that the tubes they get will be matched to the job for dependable service coupled with utmost economy. When railroads and equipment builders bring their tube problems to B&W, they get impartial recommendations based on over 35 years' specialized experience in making and applying tubing, plus extensive research facilities and modernly-equipped specialty tube mills.

#### **B&W TUBES**

SEAMLESS. Complete range of carbon, alloy and Stainless steels. Sizes ½ in. to 8% in. O.D. ELECTRIC-RESISTANCE WELDED Carbon steel grades. Sizes: ¼ in. to 4 in. O.D.

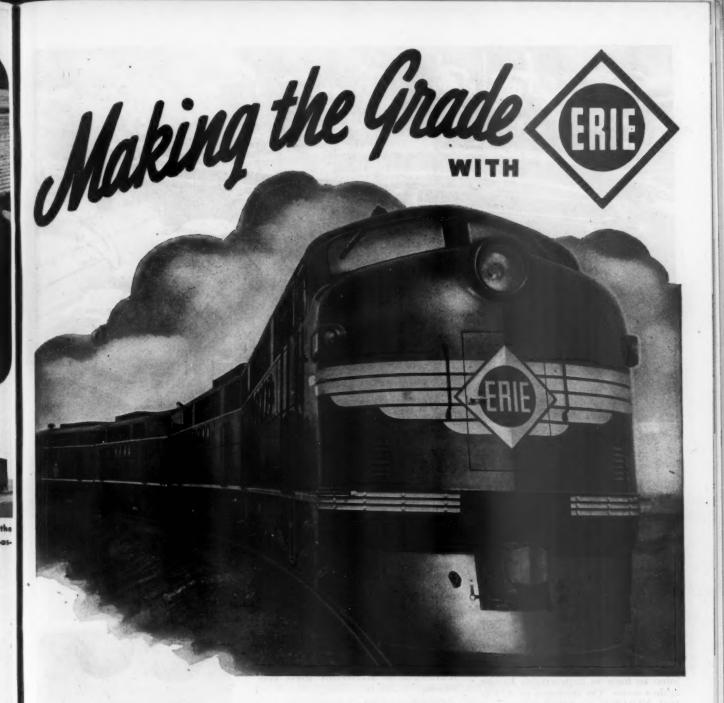
#### THE BABCOCK & WILCOX TUBE CO.

Welded Tube Division
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TA 1319



• Ironing out the grades is the particular assignment of Erie's new Electro-Motive Diesel locomotives. Movement of full tonnage solid freight trains over hills that once forced split handling is outstanding in the notable wartime railroading job done by this road.

In conquering grades and eliminating traffic bottle-necks the Diesel giants require highly efficient lubrication. It is provided by Sinclair Gascon GL-CC Diesel Oil, noted for wear-prevention qualities and detergent characteristics that promote clean engine operation.

Erie Railroad is a large user of Sinclair lubricants on hard worked rolling equipment over its extremely busy system.

It is one of more than 150 American railroads that use Sinclair products.

## SINCLAIR RAILROAD LUBRICANTS

SINCLAIR REFINING COMPANY, RAILWAY SALES, NEW YORK . CHICAGO . SAINT LOUIS . HOUSTON

March, 1945

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#### **HOW MANY HAVE WAR ULCERS?**

### "IN THE PINK" WITH APEXIOR SURFACING MATERIALS

You can overcome the tedious cleanings of boiler flues, shells and firebox sheets by coating them with APEXIOR NUMBER 1. An APEXIORIZED surface stays clean longer . . . wears longer . . . and washes more effectively. Dirt and scale do not bond as tightly to an APEXIORIZED surface.

APEXIOR NUMBER 1 is a brushapplied corrosion-proof surfacing material that seeps into the metal pores and joints to form an impenetrable barrier against water. The thickness of APEX-IOR NUMBER 1 applied is approximately .0025". It does not retard heat transmission.

APEXIOR NUMBER 1 is not a substitute for feed-water preparation or chemical treatment. It supplies protection for metal in service under boiler water and steam temperatures and pressures, supplementing the work of the chemist and water service engineer by increasing the durability and raising the surface quality of the boiler metal. Here is the simplest and most effective kind of

mechanical cooperation with the Water Service Department.

#### APEXIOR . . . TIME TESTED

Service experience of five years on steam locomotive boiler interiors is now available. These records demonstrate conclusively that APEXIOR effectively retards or checks corrosion and pitting in locomotive boilers, and cleaning time is reduced when flues are removed.

APEXIOR surfacing is recommended for stay bolts and other water contact areas subjected to the hazard of embrittlement or accelerated stress corrosion.

For protecting the interior of cisterns of locomotive tenders APEXIOR NUM-BER 3 is recommended. This is brushapplied cold and dries to a smooth, shiny jet black. It resists all chemicals used in treating boiler water, also protects surfaces in contact with potable water.

#### NO SCARCITY OF THIS ARMOR PLATE

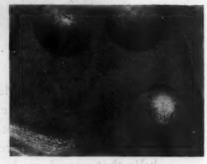
Both APEXIOR surfacing materials are available. They are being shipped to hundreds of industrial power plants,

utilities and for marine construction and operation as well as to railroads.

More and more railroads are coating new and old surfaces alike with APEXIOR to

- 1. Overcome manpower shortage
- 2. Save metal
- 3. Save time
- 4. Save money

Ask for bulletin.



APEXIOR surfaced boiler plate and rivet beads after two years of service under 215 pounds boiler operating pressure. Note brush marks and thickness of film over plate markings. Observe that no metal is exposed.

Keeps new metal new

CHICAGO



Gives old metal new life

DETROIT

THE DAMPNEY COMPANY OF AMERICA HYDE PARK 36, BOSTON

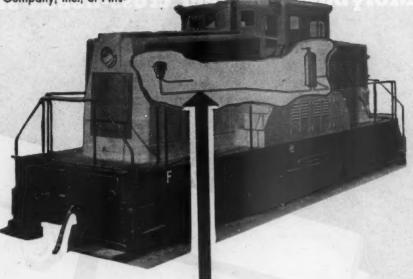
NEW YORK

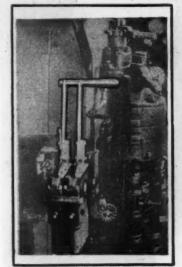
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ATLANTA

PHILADELPHIA

Below is shown the progressive 80-ton Diesel-Electric Switcher, built by the H. K. Porter Company, Inc., of Pittsburgh, Pennsylvania.





The slightest movement of the throttle is hydroulically transmitted to the motor speed control.

SPERRY'S HYDRAULIC CONTROLS minimize design problems by means of a single connecting tube that can be bent around corners and obstacles or installed through bulkheads, thus reducing design, installation, and maintenance costs.

The H. K. Porter Company, Inc., of Pittsburgh, makers of the well-known Porter Diesel-Electric Switchers, now feature-"fingertip control" on their locomotives. This selection adds another application of the Sperry Hydraulic Control; a single-line remote control and positioning device, used successfully by many and varied industries. This is what the H. K. Porter Company has to say about the Sperry Control:

- "The installation assures accurate synchronization of the speed of the two diesel engines in the double power plant.
- It accomplishes this by eliminating the necessity for mechanical linkage from the operator station to the engine by means of flexible piping.
- This method has advantage over previous installations because it does away with troublesome rods, jaws, pins, cables, pulleys, and turnbuckles, and the necessity for mechanical alignment.
- It eliminates lost motion of the mechanical method, back lash, and need for constant adjustment. Just as the installation is easy to design and build, so is it easy to maintain. The control gives instant and accurate response to the slightest movement of the throttle."

EASY INSTALLATION . . . DEPENDABLE . . . ACCURATE

Send for Bulletin 78 for additional details

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For Scientific Achievement

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Molybdenum steel cross-heads stay on the job.

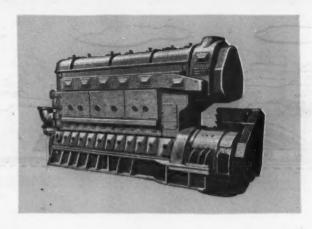


CLIMAX FURNISHES AUTHORITATIVE ENGINEERING



MOLYBDIC OXIDE, BRIQUETTED OR CANNED

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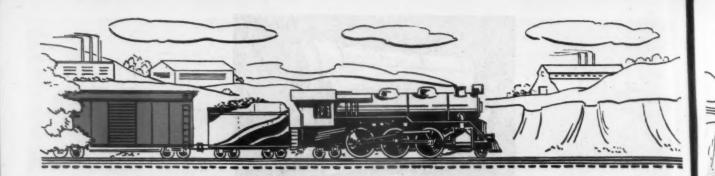
norrow's power today!...It's the Opposed-Piston Diesel Locomotive

Fairbanks-Morse

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Simplify your weight-reduction problems

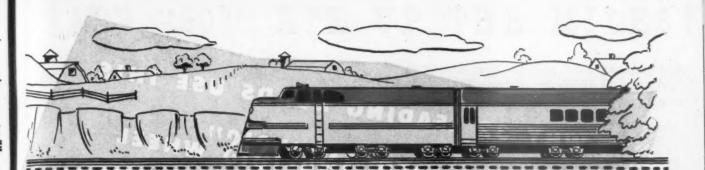
by choosing from these...

SHIGH STRENGTH STEELS

now made by Republic

REPUBLIC ALDECOR
REPUBLIC COR-TEN
REPUBLIC DOUBLE STRENGTH

Other Republic Products include Carbon, Alloy and Stainless Steels . . . Bars, Plates, Sheets, Strip,



F you are looking for the material which will do the best job of reducing dead-weight of equipment at low cost and without sacrifice of safety, Republic offers you not one or two, but THREE High Strength Steels from which to make your selection - ALDECOR, COR-TEN and DOUBLE STRENGTH.

While these three low-alloy steels are quite similar in most respects, certain differences may cause you to prefer one over the other two. Because of this, Republic believes that its policy of providing industry with steels and steel products for practically every need requires the production of all three steels.

COR-TEN and DOUBLE STRENGTH STEELS, with a background of more than ten years' experience, are well known to industry. ALDECOR, the most recent development in high strength steels, will be preferred by certain users for various applications as it becomes better known.

Like COR-TEN and DOUBLE STRENGTH-STEELS, ALDECOR provides a minimum yield point of 50,000 pounds per square inch, is resistant to atmospheric corrosion and is easy to work and weld. These steels are equal in abrasion resistance to carbon steels of the same physical properties. They are produced in bars, plates, sheets and strip.

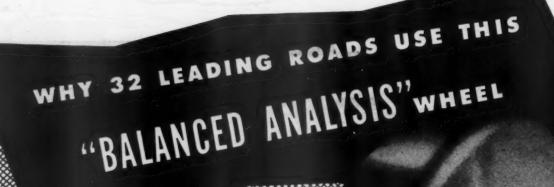
No hard and fast rules can be laid down as to which of these three high strength steels will be best suited to your particular needs. The factors governing each application must be carefully considered.

And that is where Republic metallurgical engineers come into the picture. Equipped with long experience in the application of steels to transportation equipment and various types of machinery where weight reduction can mean increased pay-load, lower operating costs, greater efficiency and decreased maintenance, they are prepared to . study your individual requirements and to work with your own staff.

One of these specialists is ready to talk to you NOW about ALDECOR, COR-TEN and DOUBLE STRENGTH STEELS. When may he call?

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There's a reason why ARMCO Stress Resistant Wheels are rolling under cars operated by 32 of the country's leading railroads.

Their exclusive "balanced analysis" means more and safer miles.

S-R Wheels stay in service longer because they have lower internal stresses right at the start. And they continue to resist stresses built up in service.

"Balanced analysis" gives you a wheel with the highest resistance to wear and shelling for a given resistance to thermal cracking. Its resistance to thermal cracking is equalled only by wheels with a lower carbon content.

This means trouble-free service and high safety standards—the ability to "take it" in punishing wartime traffic. Get all the facts on ARMCO Stress Resistant Wheels from our nearest office, or write direct to the Armco Railroad Sales Co. Incorporated, 891 Curtis Street, Middletown, Ohio.

EXPORT: THE ARMCO INTERNATIONAL CORPORATION

#### ARMCO STRESS RESISTANT WHEELS

"The Wheel of Tomorrow is Rolling Today"



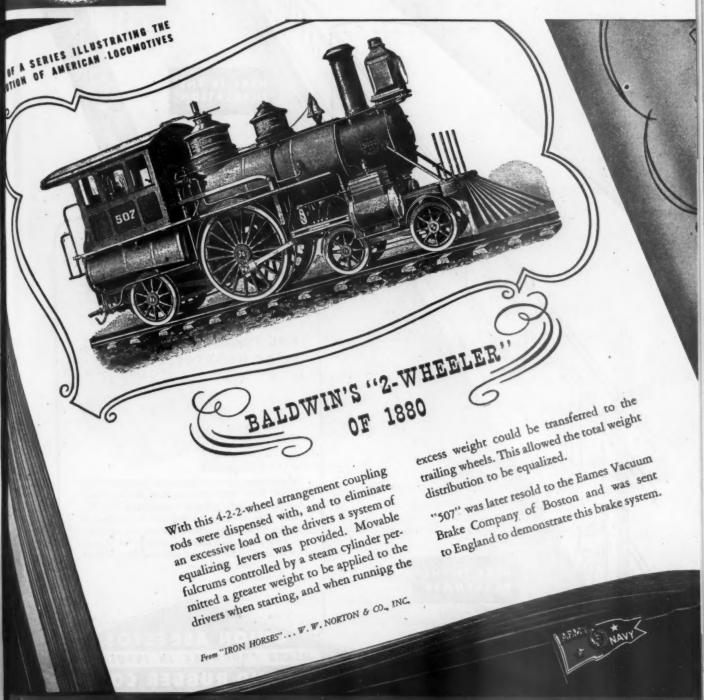
# DLD "507" ATE UP THE MILES!



With Wooten's boiler and an unorthodox driving arrangement, this Baldwin-built locomotive of 1880 established a two-hour "time table" run between Philadelphia and New York - a record that was soon cancelled by engines equipped with . . .

#### Union WEB Spoke Driving Wheel Centers

- \*Cruciform section spokes for great additional strength.
- Reinforced rim support to eliminate flat spots, out of roundness, etc.
- ★Correct distribution of metal for better balancing of smaller diameter wheels.
- \* Wheels easily inspected before and after installation.
- ★ Troubles due to shrinkage eliminated by simplicity of design.
- ★ Can be made to any material specification.



UNION STEEL CASTINGS BLAW-KNOX CO. PITTSBURGH, PA.

HERE IS THE

HERE IS THE

# WOVENSTONE

THE PASSENGER
IS COMFORTABLE



Wovenstone provides permanent protection for steam lines from the ravages of weather—maintains highest possible temperatures from the locomotive back to the last car of the longest trains. Wovenstone will not loosen, sag or shake down—remains firm and snug against the pipe at all times. Can be removed and reapplied without loss of original efficiency.

UNION ASBESTOS
MEANS PROGRESS IN INSULATION

AND RUBBER CO



UP THE MILES!

310 S. MICHIGAN AVE., CHICAGO 4 NEW YORK SAN FRANCISCO WAR BONDS!

Another convincing example of roller bearing locomotive availability



The General Superintendent of Motive Power of a large Southeastern railroad writes as follows:

"During the month of May, 1944 the Railway had in service 320 steam freight locomotives; 103 of these or 32.2% are equipped with \*roller bearings. These 32.2% of the steam freight locomotives made 73.2% of the total freight mileage."

Locomotives equipped with Timken Roller Bearings on all axles, including driving axles, consistently roll up greater mileages than similar locomotives operating on friction bearings because they are on the road more of the time—in the shop less.

Most existing locomotives can be converted to Timken Bearings. It will pay you to consider converting *your* locomotives *now*. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

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QUENCHED AND TEMPERED

#### **NICKEL STEEL**

**FORGINGS COMBINE** 

# EXCEPTIONAL DUCTILITY WITH HIGH TENSILE STRENGTH

Composition and Typical Properties of Normalized Quenched and Tempered 24% Nickel Steel Rods

Description or Size	Melt Yield Pt. No. #s per Sq. In.	Tensile Strength #s per Sq. In.	Elong. % in 2 In.	Reduc- tion in Area %	ANALYSIS						
					Cor.	A	Aang.	Phos.	Sul.	Sil.	Ni
Main Rod	92900	110000	25.0	64.4	.31	•	.78	.027	.026	.25	2.75
Main Rod	86500	104500	25.5	65.6	.32		.86	.034	.032	.29	2.69
Main Rod	86360	104400	26.0	64.8	.321		.86	.034	.032	.29	2.69
Main Rod	87850	102350	26.0	66.2	.31		.89	.037	.025	.32	2.69
Front Rod	36000	102250	25.0	67.3	.29		.82	.035	.027	.24	2.71
Front Rod	83900	104250	25.0	66.1	.29		.82	.035	.027	.24	2.7
Front Rod	86850	104250	27.0	66.1	.32		.86	.035	.025	.30	2.65
Front Rod	89500	107050	25.5	65.6	.32		.86	.035	.025	.30	2.65
Back Rod	89500	107650	25.0	62.7	.30		.79	.030	.025	.22	2.7
Bock Rod	87500	106450	25.0	65.4	.29		.82	.035	.027	.24	2.7
Back Rod	87000	105600	25.0	65.4	.29		.82	.035	.027	.24	2.7
Back Rod	88150	104850	26.0	66.8	.29		.82	.035	.027	.24	2.7

Specimens Taken from Mid-Section of Prolongations of the Forgings

4

The above table compiled by the American Locomotive Company shows the chemical compositions and mechanical properties of some normalized, quenched and tempered nickel steel front, main and back rods recently produced as replacement rods for locomotives being speeded up and rebalanced. These values are typical of replace-

ment rod forgings recently tested by that company.

Quenched and tempered nickel steel forgings of this type provide high tensile strength and ductility. combined with unusual toughness and high fatigue strength—qualities which tend to obviate breakage when employed as rods in railroad service.

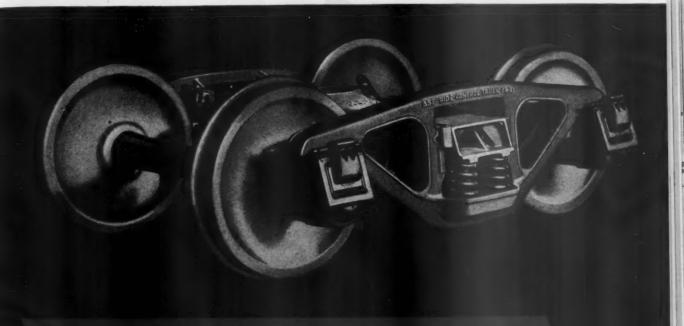
A booklet entitled,
"NICKEL ALLOYS IN
RAILWAY EQUIPMENT,"
describes important and
varied uses of nickel steels
and other alloys of nickel.
Send for your copy today.



\* Nickel \*

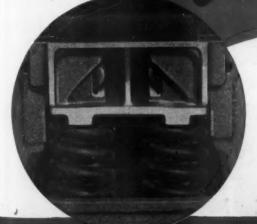
THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall St., New York 5, N. Y.

THE TRUCK FOR TODAY'S NEED...TOMORROW'S SPEED!



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NO SPRING PLATES



The A. S. F. Ride-Control Truck (A-3) can be relied upon for easy-riding, dependable service with low maintenance expense. And chief among the reasons-why is the fact that the Ride-Control prevents the development of destructive harmonic oscillation. All bolster motion, both vertically and laterally, is cushioned and controlled by spring pressure to assure smooth, easy operation. Then, too, the Ride-Control Truck is rugged and simple in construction. Without spring plates or spring planks, providing the simplest of assemblies, this truck is designed to keep more freight cars moving, more of the time.

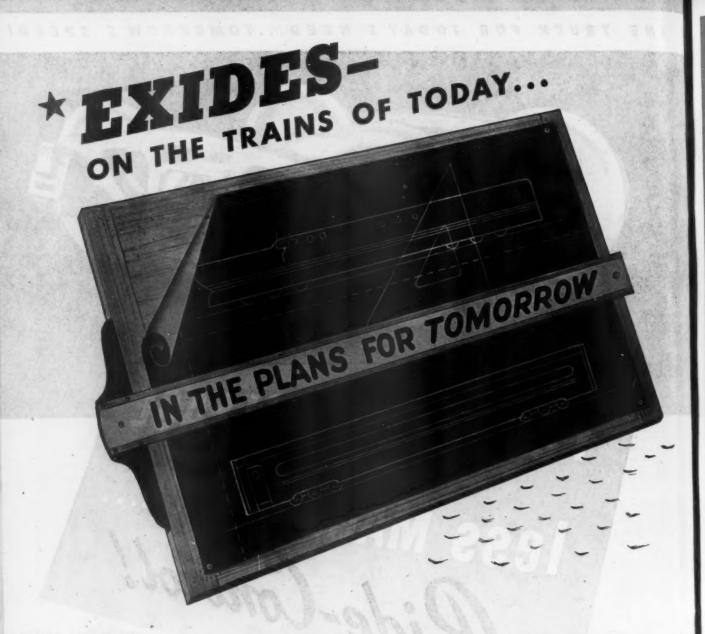
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UCH has been told of the improvements that America's railroads have planned for tomorrow—increased speeds, greater safety, and added comforts and conveniences for passengers. Some of these innovations will be electrical—storage battery operated —calling for high and sustained power.

Exide Batteries will be on many of tomorrow's finer trains, performing efficiently and economically, and with ample power to meet the newer demands. Today, powerful, rugged Exides are lighting and air-conditioning passenger cars, cranking Diesel engines, powering train telephone and signal systems, and supplying current for a multitude of other tasks. Whatever the job, you can count on Exides for dependability, long-life and ease of maintenance



THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

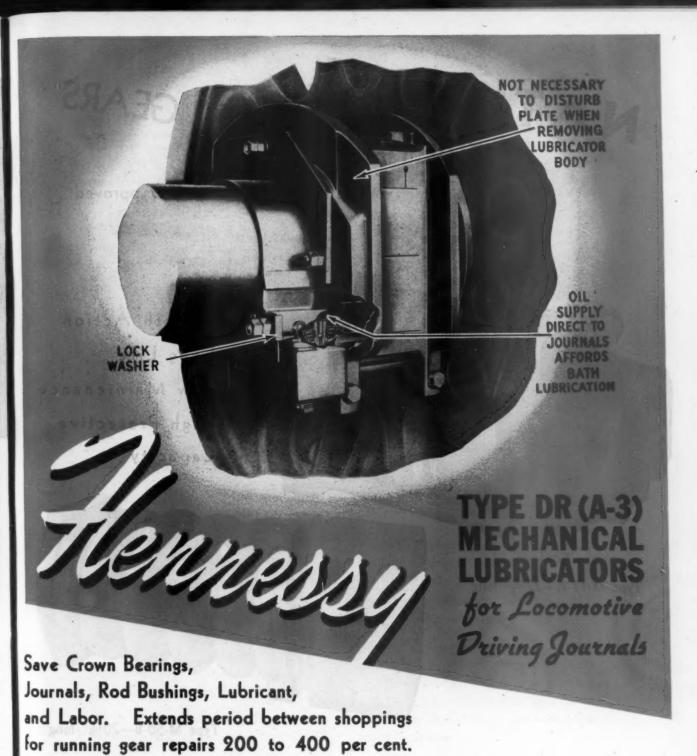
Exide Batteries of Canada, Limited, Toronto

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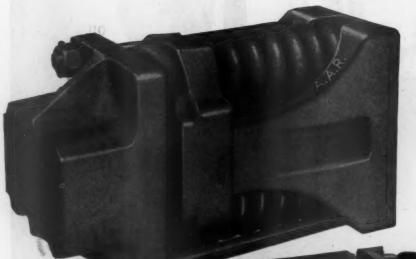
HENNESSY LUBRICATOR COMPANY INC

75 West Street, New York 6, N. Y.

Hennessy Mechanical Journal Lubricators on driving, lead, trailing truck or tender journals are in use on 35 American railroads and in many foreign countries. Their use increases overall availability and it is not unusual for locomotives to operate continuously in excess of 200,000 miles without any repairs to driving boxes or journals. The savings in material, man hours and lubricant with such operation under existing conditions, is materially contributing to the war effort.

# NATIONAL FRICTION DRAFT GEARS

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Smooth Action
Long Life
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Capacity

Type M-17-A-22%" long

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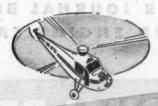
THERE'S A BIG advantage in having intricate parts produced by a single organization under single, controlled responsibility. No buck-passing, no costly delays. Long before Pearl Harbor we built a reputation on volume production of industrial and aircraft engine parts, large or small, hardened and ground, micro-finished.

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While we're now geared to total war output, we may have an open capacity on your parts problem ... so why not write our Executive Sales Office for an impressive booklet on our complete plant facilities.

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# GET IT BACK INTO SERVICE

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#### WITH REPUBLIC

#### ELECTRUNITE BOILER TUBES

• Every day that a locomotive is laid up for boiler re-tubing, it costs you real money. So get it back into operation in a hurry. And Republic ELECTRUNITE Boiler Tubes will help you. ELECTRUNITE Tubes slide in freely—because they're uniform in size and diameter. Every ELECTRUNITE Tube rolls in smoothly and beads to a tight joint—because it is full normalized throughout, insuring freedom from hard spots in the metal, and because it is uniform in wall thickness and ductility.

These tubes are free from scale and corrosion-inviting scale pits. They are as clean and free from defects inside as out—because the inside surface is open to inspection before forming into a tube.

Thirteen years of service and more than 120,000,000 feet of ELECTRU-NITE Pressure Tubes installed have written the story of their safety and economy on the records of ELECTRUNITE users. They can do the same for you—and we're ready to tell you how.

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Republic

ELECTRUNITE

BOILER, CONDENSER AND HEAT EXCHANGER TUBES



# The touch of TOMORROW

# A FORESHADOW OF THE FUTURE IN 1938

Lightweight, all-welded Con-TRN box car weighs 8,500 lb. less than A.A.R. standard, yet is designed to exceed A.A.R. strength requirements strength requirements.

In order to produce a balanced design each member of this car was carefully analyzed from a stress viewpoint to obtain the greatest possible weight saving and yet retain adequate strength.

Substantial weight reduction was accomplished by building with low-alloy, high-strength Cor-Ten.

Although the minimum yield point of this steel is more than twice that of ordinary open-hearth steel, an average of only one-third was deducted from the thickness of Cor-Trn used in this design. In other words, greater reductions in thickness—and weight could safely have been made, without reducing strength below A.A.R. requirements.

Insofar as it provides the desirable combination of light weight and strength, this car, which insures greater payload capacity as well as reduced operating and maintenance costs, is a true prototype of the cars of the future.

GABX 1940



UNITED STATES

### ... in the freight cars of TODAY

# AL AMERICAN ORTATION CORP.

# "Lightweight design and COR-TEN construction"

NO ONE knows what the freight car of the future will look like. But one thing seems certain. They will be lighter.

The benefits of lightweight construction have been so plainly demonstrated during these war years that they cannot be ignored.

In 51,032 lightweight COR-TEN cars now in service, payload capacity has been increased an average of 2.56 tons per car. Decreases in operating costs have been estimated at some \$45 per car per year. Maintenance costs have been low. As regards availability for service, this COR-TEN equipment has stood the tough test of wartime operation with flying colors.

On these facts, forward looking men in railroad management are basing their plans for the elimination of dead weight in postwar car construction. They know that without modern, lighter cars it will be impossible to effect the economies that will permit maintenance of streamlined freight service that will attract shippers from competing forms of transportation.

Now, with Cor-Ten—the pioneer low-alloy, high-strength steel—again available for freight car construction, your new equipment can be built lighter, stronger, longer-lasting and more efficient than ever before. Our engineers will gladly show you how lightweight construction with Cor-Ten can be applied to your designs, what it will cost and the sound economic reasons that justify its use.

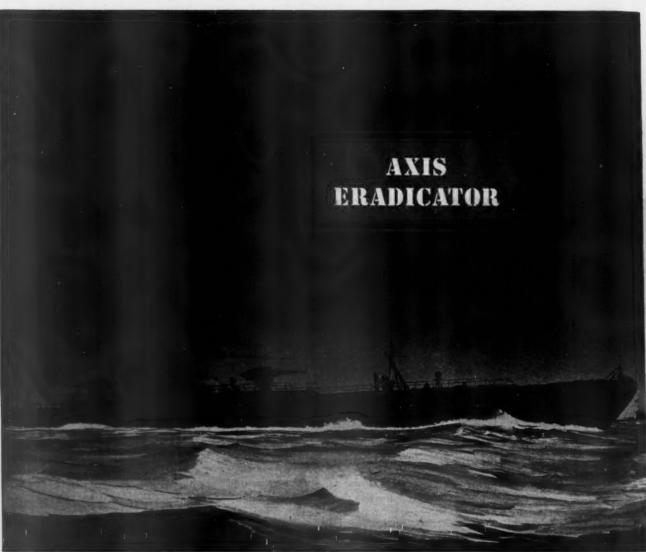
AMERICAN STEEL & WIRE COMPANY, Cleveland, Chicago and New York
CARNEGIE-ILLINOIS STEEL CORPORATION, Pittsburgh and Chicago
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TENNESSEE COAL, IRON & RAILROAD COMPANY, Birmingham

United States Steel Supply Company, Chicago, Warehouse Distributors
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Official U.S. Navy Photo

#### **FEDERATED Brass and Bronze Alloys**

are used in ever increasing amounts by the builders of these and other "axis eradicators".

From periscope to torpedo, the submarine is a precision built instrument of destruction. It is essential that its constituent metals be above reproach in quality and uniformity. Federated brass and bronze alloys are of uniform high quality due to advanced technical knowledge and precision control of metallurgical processes.

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All of these in standard specifications. Special alloys to your order.



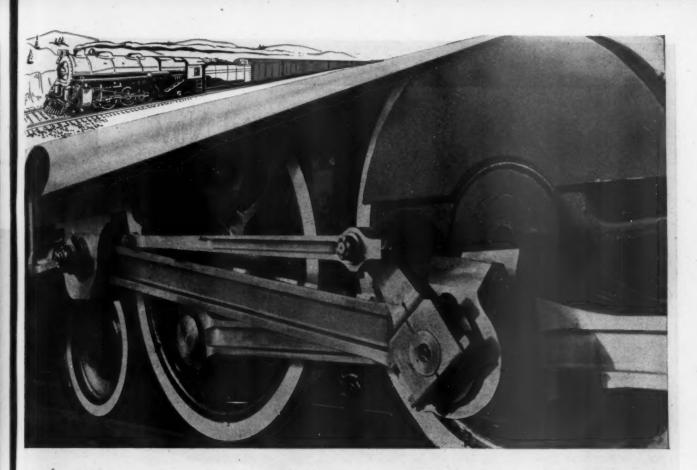
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# For Safety in Highly Stressed Parts

#### -No Other Material Can Equal ALLOY STEELS

When it becomes impractical or impossible to further enlarge sections of operating parts to increase strength, especially where concentration of stresses occurs, the answer probably will be found in Republic Alloy Steels.

Alloy Steels provide an outstanding combination of qualities found in no other material including those properties essential to safety in designing light-weight equipment to carry heavier loads at higher speeds.

For in alloy steels you will find highest strength values and the most favorable strength-to-weight ratio. You are assured of greatest toughness. You have at your command the widest range of

hardenability and a knowledge that hardened areas will be uniform in their resistance to wear.

Add to these qualities resistance to fatigue-a very

important quality in highly stressed working parts—resistance to heat and cold—resistance to corrosion—and you have a material with the ability to insure safety, to extend service life of equipment, and to cut maintenance and replacement costs.

Republic—world's leader in the production of alloy steels—is ready to discuss the advantages of these steels as applied to your individual uses. Write us.

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ning. And they're longer-lived and far more weather and water-resistant than any V-Belts before.

There's probably a Dayton man right there in your own yard, with "cinders in his hair" who shares your vision for the railroads. He'll give you the kind of service that's never reflected in "price."

Look him up. He's straight from Daytons own Railway Division. He is able to give you all the technical data, collected by Dayton Rubber in more than 40 years . . and supply you with V-Belts made in the most modern of factories, that manufacture more V-Belts today than any other company in the world. Look him up. He is there to help you.

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Pioneers of Railway V-Belts and Connectors— The World's Largest Manufacturer of V-Belts

SPECIALIZED MANUFACTURER FOR THE R, R, INDUSTRY

KEEP ON BUYING WAR BONDS



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#### For Today's Freight Car Rehabilitation Program

The new Monroe Airplane Type Hydraulic Shock Absorber especially designed for freight car trucks, is now available for your rehabilitation program. It embodies the same exclusive Monroe Hydraulic Shock Absorber principles first to be accepted for use on America's railway passenger cars to make high speeds safe and practicable.

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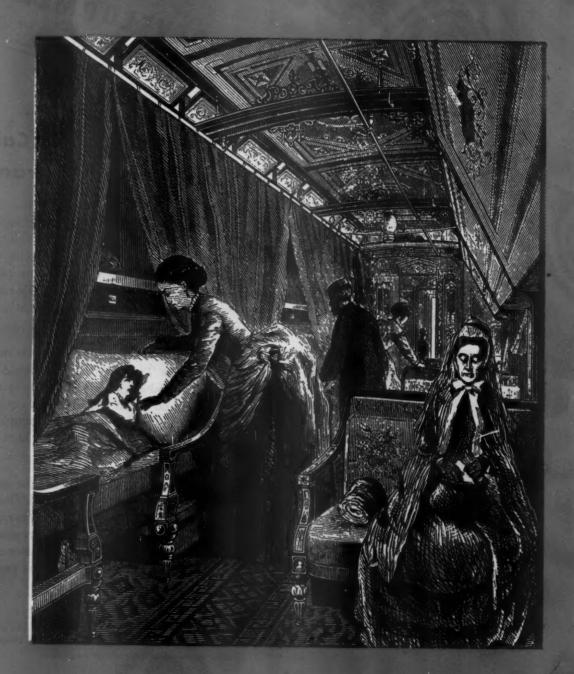
> sorber minimizes vertical and swaving action and protects lading and equipment. Maintenance costs and damage claims are reduced and cars are kept at work longer.

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In use since 1938 on high speed crack streamliners, Monroe Air-RAILWAY SUPPLY DIVISION plane Type Hydraulic Shock Absorbers have smoothed the ride and saved thousands of man hours' maintenance time. They demonstrate the soundness of exclusive Monroe Hydraulic Shock Absorber principles.

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POSTWAR PASSENGERS WILL PATRONIZE CARRIERS THAT OFFER THE MAXIMUM COMPORT, SERVICE, SPEED AND SAFETY.

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# ...but they expect it now!

Trecipition to Eliminate That "SOILED FEELING"... PERMIT SMOKING IN EVERY CAR

The problem of properly cleaning the ventilating air in passenger cars has plagued railroad men for years. Commonly used mechanical filters can remove only the larger dirt, soot, and smoke particles. Yet 80 to 90 per cent of the total number of air-borne particles are so small that they "leak" through mechanical filters.

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PASS THROUGH AN ELECTROSTATIC PIELD

RECEIVE A POSITIVE CHARGE

AND ARE DRAWN TO A COLLECTION PLATE OF OPPOSITE POLARITY

WHERE THEY REMAIN UNTIL FLUSHED AWAY

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This gigantic job was only made possible by dependable motive power and rolling stock—much of it equipped with sturdy

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# GET IT BACK INTO SERVICE

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## ELECTRUNITE BOILER TUBES

• Every day that a locomotive is laid up for boiler re-tubing, it costs you real money. So get it back into operation in a hurry. And Republic ELECTRUNITE Boiler Tubes will help you. ELECTRUNITE Tubes slide in freely—because they're uniform in size and diameter. Every ELECTRUNITE Tube rolls in smoothly and beads to a tight joint—because it is full normalized throughout, insuring freedom from hard spots in the metal, and because it is uniform in wall thickness and ductility.

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STEEL AND TUBES DIVISION . CLEVELAND 8. OHIO

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ELECTRUNITE

BOILER, CONDENSER AND HEAT EXCHANGER TUBES



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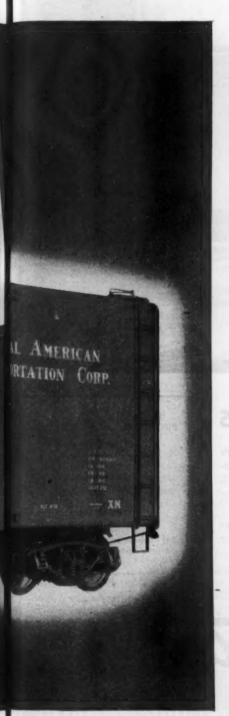
LD LMT 132200 LT WT 38800 NEW 11-38





UNITED STATES

## ... in the freight cars of TODAY



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Now, with Cor-Ten—the pioneer low-alloy, high-strength steel—again available for freight car construction, your new equipment can be built lighter, stronger, longer-lasting and more efficient than ever before. Our engineers will gladly show you how lightweight construction with Cor-Ten can be applied to your designs, what it will cost and the sound economic reasons that justify its use.

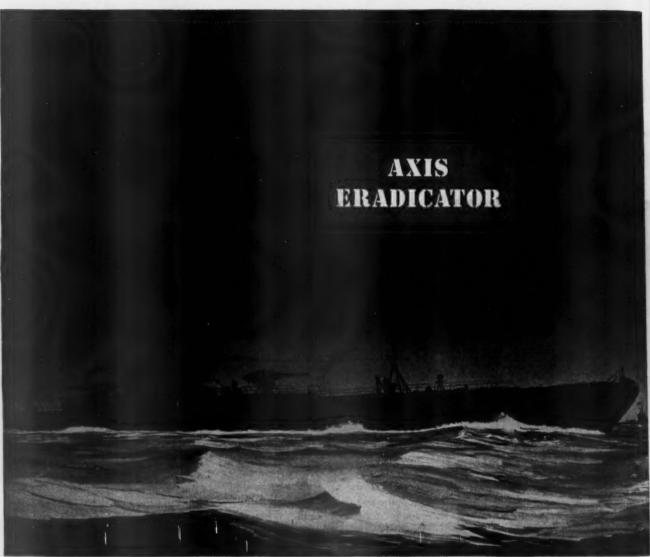
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United States Steel Supply Company, Chicago, Warshouss Distributors
United States Steel Export Company, New York





Official U.S. Navy Photo

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From periscope to torpedo, the submarine is a precision built instrument of destruction. It is essential that its constituent metals be above reproach in quality and uniformity. Federated brass and bronze alloys are of uniform high quality due to advanced technical knowledge and precision control of metallurgical processes.

Federated Metals will meet your requirements and save you money. Your inquiry will receive prompt attention from the Federated Office nearest you. INGOT METALS AND WHITE METAL ALLOYS PRODUCED BY FEDERATED

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All of these in standard specifications. Special alloys to your order.



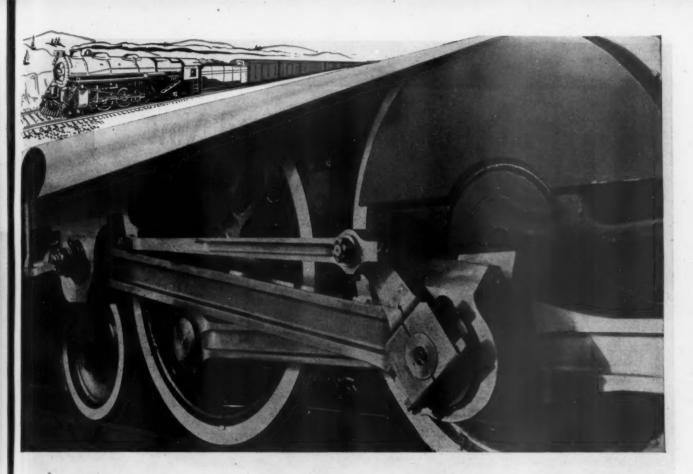
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# For Safety in Highly Stressed Parts

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Add to these qualities resistance to fatigue—a very

important quality in highly stressed working parts—resistance to heat and cold—resistance to corrosion—and you have a material with the ability to insure safety, to extend service life of equipment, and to cut maintenance and replacement costs.

Republic—world's leader in the production of alloy steels—is ready to discuss the advantages of these steels as applied to your individual uses. Write us.

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Also Carbon and Stainless Steels—Sheets—Plates—Pipe—Upson Bolts, Note and Rivers—Dectronite Boller Tube



up. He is there to help you.

THE DAYTON RUBBER MANUFACTURING CO.

DAYTON 1, OHIO

Pioneers of Railway V-Belts and Connectors—
The World's Largest Manufacturer of V-Belts

today than any other company in the world. Look him

SPECIALIZED MANUFACTURER FOR THE R. R. INDUSTRY

KEEP ON BUYING WAR BONDS

V-Belts by Dayton
Rubber

The Mark of Technical Excellence in Synthetic Rubber

# REW PRODUCT DEVELOPMENT

#### For Today's Freight Car Rehabilitation Program

The new Monroe Airplane Type Hydraulic Shock Absorber especially designed for freight car trucks, is now available for your rehabilitation program. It embodies the same exclusive Monroe Hydraulic Shock Absorber principles first to be accepted for use on America's railway passenger cars to make high speeds safe and practicable.

By controlling destructive vibration the new Monroe Airplane Type Hydraulic Shock Ab-

sorber minimizes vertical and swaying action and protects lading and equipment. Maintenance costs and damage claims are reduced and cars are kept at work longer.

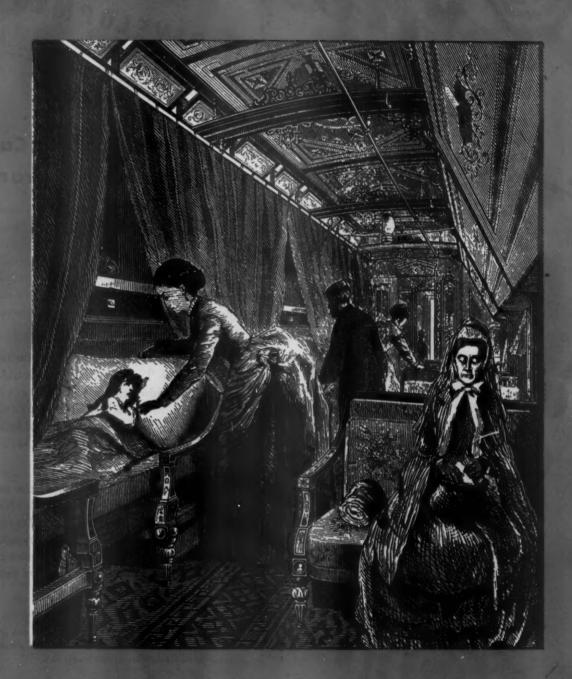
Easily and quickly installed, the new Monroe Airplane Type Hydraulic Shock Absorber for freight car trucks fits right in, with no holes to drill. It replaces one of the springs in the cluster... quickly pays for itself and pays profit through savings effected.

Our engineers will gladly work with you in the application of this modern new Monroe Airplane Type Hydraulic Shock Absorber for the rehabilitation of your freight cars.

RAILWAY SUPPLY DIVISION

In use since 1938 on high speed crack streamliners, Monroe Airplane Type Hydraulic Shock Absorbers have smoothed the ride and saved thousands of man hours' maintenance time. They demonstrate the soundness of exclusive Monroe Hydraulic Shock Absorber principles.

# idn't have it t



POSTWAR PASSENGERS WILL PATRONIZE CARRIERS THAT OFFER THE MAXIMUM COMPORT, SERVICE, SPEED AND SAFETY.

odernize with Westinghouse

# ...but they expect it now!

Trecipitron to Eliminate That "SOILED FEELING"... PERMIT SMOKING IN EVERY CAR

The problem of properly cleaning the ventilating air in passenger cars has plagued railroad men for years. Commonly used mechanical filters can remove only the larger dirt, soot, and smoke particles. Yet 80 to 90 per cent of the total number of air-borne particles are so small that they "leak" through mechanical filters.

Precipitron, the electronic air cleaner, is the only really effective method to clean the air in passenger cars. Precipitron collects dirt particles as small as 1/250,000 of an inch : . . even traps tobacco smoke.

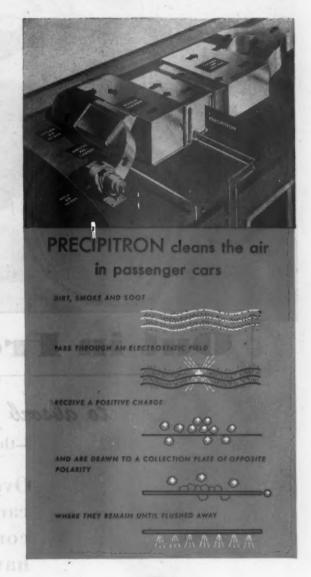
With Precipitron, every car becomes a smoker... every car is filled with clean and refreshing air. And with the car cleared continually of smoke and other dust, the heating problem is simplified. It is not necessary to exhaust from the car such a large portion of air. Because more of the air is recirculated, the amount of cold make-up air to be heated is greatly reduced.

Write Precipitron into your postwar passenger car specifications. It is sure-fire passenger comfort. Westinghouse Electric & Manufacturing Company, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-15096

CONSULT WESTINGHOUSE on your plans for passenger car modernization. Available are axledriven generators for high-speed operation; axlegenerator control; compressor motor and control; fluorescent lighting equipment and fixtures; Precipitron for electrostatic air cleaning; water coolers; Nofuze circuit breakers; and other equipment for efficient operation of cars.

\*Trade-mark registered in U.S. A.







# rotecting rolling stock investment



#### Out in Front

to absorb shocks at the couplings

-thus protecting the entire car structure.

Over 98% of the cars in freight carrying service are A. A. R. construction and over 96% have Friction Draft Gears.

Cardwell Westinghouse Co., Chicago Canadian Cardwell Co., Ltd., Montreal





KATHANODE POSITIVE GRID with its box-type pockets and reinforcing bar.



**BLACK OXIDE** active material with its core of pure lead.



**QLASSKLAD** spun glass retainer mat pioneered in America by Gould.



#### KATHANODE GLASSKLAD

Distinctive in Design . . . Outstanding in Performance

Gould research and Gould's half century of battery experience are responsible for these exclusive features: (1) The Kathanode grid for long life and high conductivity. (2) Black Oxide active material for sustained capacity. (3) Glassklad protection to minimize power loss.

These features are the heart

of your battery, and assure sustained power throughout a long battery life. Only when you buy a Gould Kathanode do you get these distinctive features pioneered by Gould. For 20 years "Glassklad", developed by Gould for its Kathanode battery, has meant long life and outstanding performance.

Write Dept. 63 for Catalog 800 on Gould Kathanode Glassklad Batteries for Carlighting and Air-Conditioning Service.

GOULD

SINCE 1898... THE BATTERY PICKED BY ENGINEERS

FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT

GOULD STORAGE BATTERY COMPUNATION, Descent How York, Toronto Amore . Compt. Compt. Compt.

Cos Angeles a North Sargan a Rock Felond a St. Paul 4 Steve City A



#### break it up, men!

Soldiers, according to tradition, broke step when crossing old-time bridges. Periodic vibration amplified by marching feet, it was feared, would cause a collapse of the structure.

Railroading has its vibration problems, too . . . particularly with high-speed trains. As engineers well know, cycles of vertical or lateral oscillation synchronize into violent forces at certain speeds. More than ten years ago Houdaille\* pioneered a double-acting hydraulic shock absorber to break up or curb these cycles.

Experience gained through millions of miles of service on the most famous streamlined trains in America today has led to greatly improved Houdaille instruments which, we believe, will contribute much to the comfort, stability and safety of post-war trains.





HOUDE ENGINEERING DIVISION OF

HOUDAILLE-HERSHEY CORPORATION

MAKERS OF HYDRAULIC CONTROLS Buffalo 11, New York

\*Pronounced-Hoo-dye

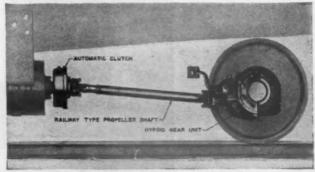


THE 20th CENTURY LIMITED, the Empire State Express, the Mercury, the Pacemaker . . . these nationally-famous trains are among those using over 2000 Spicer Positive Generator Drives on 27 different American railroads! For many years these dependable Generator Drives have been delivering steady, trouble-free power to lighting, air-conditioning and refrigeration equipment.

The Spicer Positive Railway Generator Drive consists of a very simple application of long-lived hypoid gear and pinion mounted on the standard axle. The drive from the gears is positive and constant through Spicer Universal Joints and Propeller Shaft to the Spicer Automatic Clutch mounted between the generator and the propeller shaft. This automatic clutch completely absorbs all shocks and disconnects the drive line in case of excessive overload, and also completely disconnects the generator drive at speeds below 8 miles per hour, eliminating shock loads when cars are being shunted, also preventing any additional load on the locomotive when starting. It also automatically

permits motoring of generator for electrical inspection, and driving of generator by standby motor.

Spicer Positive Railway Generator Drives can be quickly and economically adapted to new designs and reconditioning jobs. Spicer has 42 years of experience available to help you with your individual drive problems—write for further details and literature.



Exterior and cross-section view of Spicer Positive Generator Drive

SERVICE

42 YEARS OF

Positive Generator Drive



# They Save Weight where it counts most

Use of Edison Alkaline Batteries is a proved way to provide the necessary standby power capacity with the least weight.

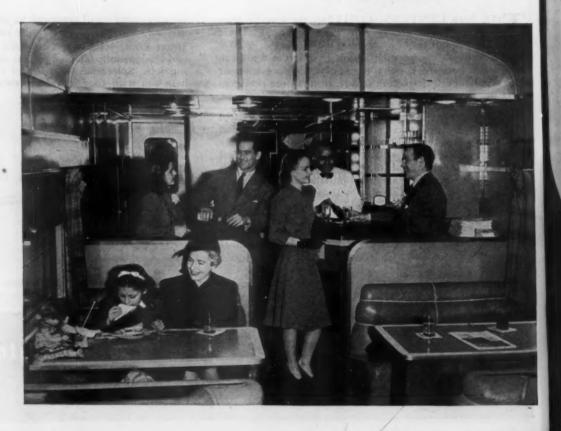
Not only are they the lightest weight type of battery available for railway-car service but they save weight where it counts most —near the middle of the car.

An outstanding reason for their light weight is their steel cell construction — a construction that gives alkaline batteries the

further advantage of unequalled mechanical strength.

Alkaline batteries are equally suitable for use in 32-volt, 64-volt or 110-volt systems. They have been giving dependable service for many years in all three. Edison Storage Battery Division of Thomas A. Edison, Incorporated, West Orange, New Jersey.

THE LIGHTWEIGHT BATTERY
FOR LIGHTWEIGHT CARS

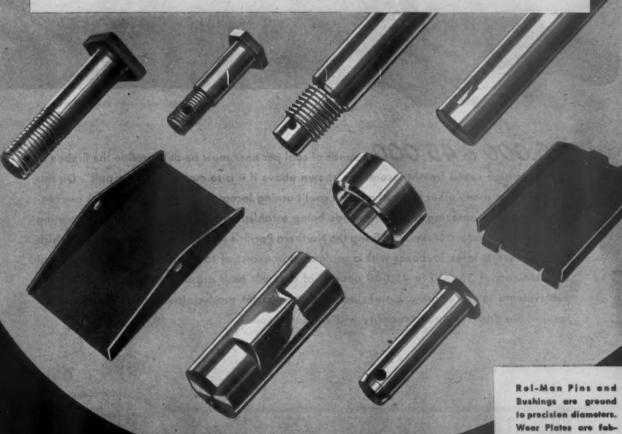


# Self-Renewing Armor Against Abrasive Wear

Rol-Man surfaces cold work-harden with abrasion and impacts; they develop hard, smooth, shiny armors against wear, yet underneath, the metal retains its original toughness to absorb shocks and resist breakage.

As a millionth of an inch of hard surface slowly wears, another millionth of hardness builds up underneath, thus the thickness of the work-hardened section maintains itself despite wear.

Use Rol-Man High (11% to 14%) Manganese Steel for Passenger Car Truck Swing Hanger Connections, Center Bearing Wear Plates, Pedestal and Box Liners, and all other parts that demand the utmost in abrasion resistance and strength . . . Manganese Steel Forge Co., 2813 Castor Avenue, Philadelphia 34, Pa.



PINS . BUSHINGS . WEAR PLATES

ricated to your specifications roady for installation.

# STANDARD STOKERS for the Long full

Guarantee **Maximum Firing Efficiency** with the Added Assurance of Dependable Operation



Courtesy of the Northern Pacific Railroad

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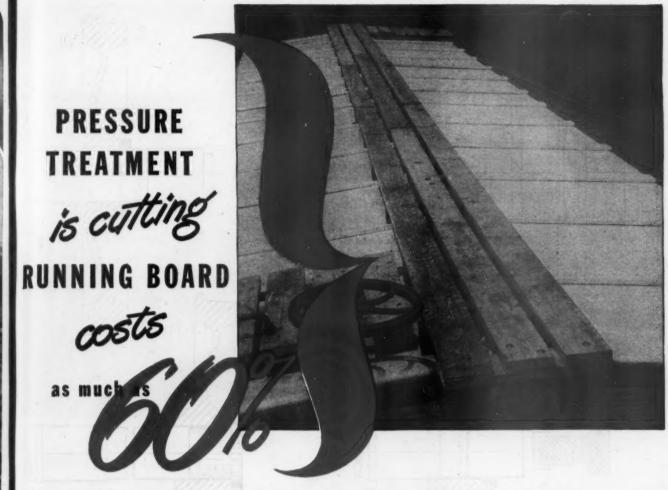
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35,000 to 45,000 pounds of coal per hour must be delivered to the firebox of the giant high speed freight locomotive shown above if it is to make "the long pull". On this as well as on many other types of modern coal burning locomotives Standard Stokers are contributing to the amazing tonnage records being established today under wartime operating conditions a Standard Stokers are firing the Northern Pacific's fleet of 4-6-6-4 locomotives which have unusually large fireboxes with a grate area in excess of 150 square feet. Maximum coal requirements of 35,000 to 45,000 pounds of coal per hour are met without difficulty. This achievement in stoker firing assures adequate power for producing sustained tractive effort resulting in greater hauling capacity with increased speed.

THE STANDARD STOKER COMPANY.

NEW YORK . CHICAGO . ER IE . MONTREAL





Running board repairs and replacements cost a pretty substantial sum each year. By standardizing on pressure-treated lumber for the installation, we believe you can save up to 60 cents out of every dollar you are spending.

According to reports from users, untreated running boards give about five years service, at an annual cost of approximately \$2.50 per car. Pressure-treated running boards can generally be ex-

pected to give about fifteen years service, at an average annual cost of less than \$1.00 per car. On this basis, the additional investment in the treated running boards is returned in the first year of added life. And after that the treated boards earn about \$2.50 per car per year during the remainder of their service life.

The direct savings are impressive . . . but the indirect gain may be even more important. Elimination of the loss of service and revenue during shopping, and of the expenses of inspection, purchasing, stores and shop departments in providing unnecessarily early replacements, may multiply the initial dollar savings many times.

Our two-page bulletin, "Pressure-Treated Lumber for Railroad Cars," will give you a digest of the treating practice of a number of representative railroads. We will be glad to send you a copy on request.

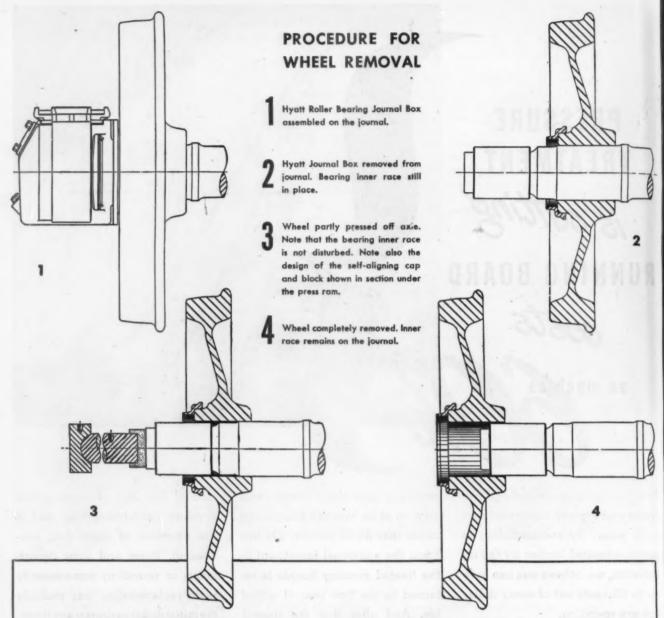
### KOPPERS COMPANY, INC.—WOOD PRESERVING DIVISION

PITTSBURGH 19, PA.

KOPPERS

Buy War Bonds and Keep Them!





# Ask the shop man what this means.

He will tell you that with Hyatt Roller Bearing Journal Boxes all wheel work can be done simply and quickly, thus reducing inspection and maintenance costs. When it is necessary to turn or remove the wheels, the Hyatt Journal Boxes can be taken off without breaking any press fits and the wheel turned on any standard wheel lathe. This is another example of why Hyatt Roller Bearings are ideally suited for railroad journal box applications. An interesting and instructive manual on Hyatt Roller Bearing Journal Box Installation and Maintenance practice is available for the asking.

HYATT BEARINGS DIVISION . GENERAL MOTORS CORPORATION HARRISON, NEW JERSEY

# HYATT ROLLER BEARING RAILROAD JOURNAL BOXES

Gu Sel

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On the drafting board, or on the assembly line, this new "Users' Guide" will tell you at a glance WHAT TYPE of Parker-Kalon Self-tapping Screw to use . . . WHERE and HOW to use it.

All the facts you need are given in only 18 pages of quick-reading tables, charts and detail drawings. You see which of the various types of P-K Self-tapping Screws will give best results in the various gauges of sheet metal, stainless steel, structural steel, various castings and forgings, in the different types of plastics and compositions, in plywood, etc., etc.

You are shown the type of hole, the size of hole, the drill size that is best for the different screw sizes and for different conditions. Other tables give you screw sizes, recommended depth of penetration, head dimensions. Also included are tables of decimal equivalents; details on special screws and head styles; practical production hints on the use of Self-tapping Screws.

This handy chart will answer the question — "Where can I use the simpler P-K Self-tapping Screw method to save man-hours, speed work, cut cost, increase security. It will help get better results from the Self-tapping Screws you now use.



SELF-TAPPING SCREWS FOR EVERY METAL AND PLASTIC ASSEMBLY

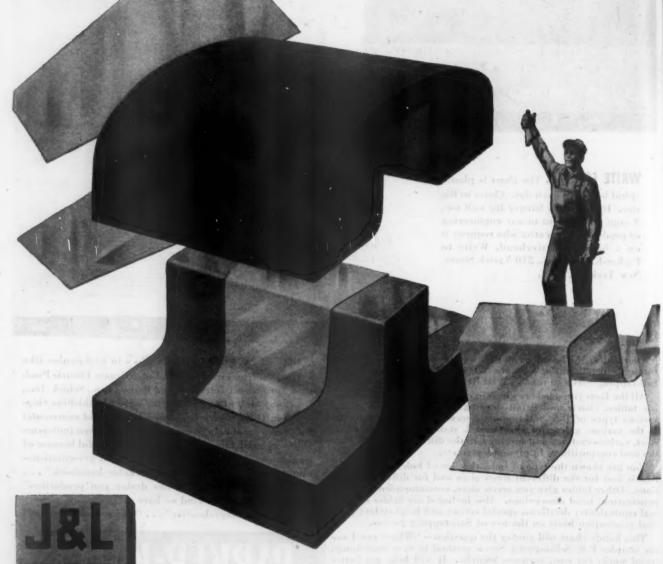
PRAISED BY PROMINENT PLANT MEN - - in companies like Frigidaire, Iron Fireman Mfg. Co., Sylvania Electric Products, Farnsworth Television and Radio Corp., Schick, Inc., Brockway Motor Co., Bendix Radio Div., Bethlehem Shipbuilding Div., Sperry Gyroscope Co. Typical comments: "Will be a great help in our work"... "Proven indispensable — we need 4 more copies"... "Very useful because of its condensed information and intelligent presentation — would like 6 more"... "A remarkable handbook"... "Will prove invaluable in our design and production"... "Best thing of its kind we have ever seeen"... "Very compact and comprehensive"... "Of inestimable value."

PARKER-KALON

Quality-Controlled

SELF-TAPPING SCREWS

# OTISCOLOY HIGH TENSILE STEEL SHEETS



A high strength steel that is easily fabricated and readily welded. May be hot or cold formed. Affords reductions in weight... its greater strength permits use of lighter gauges. Resists corrosion. Otiscoloy available in both sheets and plates for a wide variety of applications.

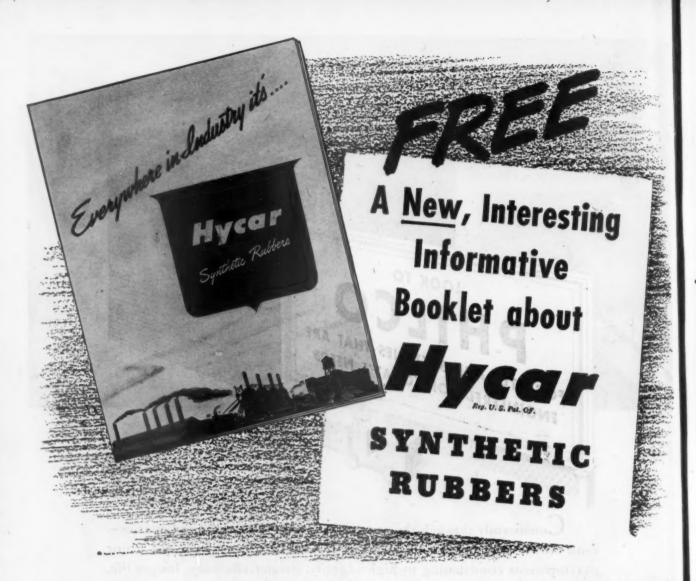
JONES & LAUGHLIN STEEL CORPORATION PITTSBURGH 30, PENNSYLVANIA



Consistently through the years, users of PHILCO Storage Batteries—both motive power and stationary types—have been first to get the major developments contributing to high capacity, greater efficiency, longer life, lower cost. Newest Philco "First" in industrial storage battery engineering is the new Philco "Thirty" with 30% longer life—now available in certain types and limited quantities for electric industrial trucks. Catalogs of modern Philco Batteries for all railroad needs gladly sent on request. Philco Corporation, Storage Battery Division, Trenton 7, New Jersey.

Philco Railroad Diesel Starting Battery Philco Railroad Car Lighting and Air Conditioning Battery





THERE is no limit to the use of resilient rubber parts having the right combination of the properties listed in the box at the right. That's why you'll want a copy of "Everywhere in Industry". It's a new, easy-to-read, generously illustrated 16-page booklet containing information that's new . . . up-to-the-minute! It covers the many important developments in Hycar synthetic rubbers that have been made in the last 3 years.

The booklet describes Hycar's characteristics in detail, provides technical data that will be helpful in suggesting new applications for this material. "Everywhere in Industry" will help you in your present and future plans.

Because of its many desirable properties, the potential uses of Hycar throughout industry are so broad it is impossible to know all the ways in which it may be advantageously used. As new applications occur to you, and you need help developing them, please call on our Technical Service Staff. And . . .

for your FREE copy of

"Everywhere in Industry"

write Department P-1, Hycar Chemical Company, Akron 8, Obio.

### Check These Superior Features of Hycar

- EXTREME OIL RESISTANCE—insuring dimer sional stability of parts.
- 2. HIGH TEMPERATURE RESISTANCE—up to 250° F. dry heat; up to 300° F. het eil.
- ABRASION RESISTANCE—50% greater that natural rubber.
   MINIMUM COLD FLOW—even at elevate.
- temperatures,

  5. LOW TEMPERATURE FLEXIBILITY—down to
- -65° F.

  6. LIGHT WEIGHT-15% to 25% lighter than many other synthetic rubbers.
- 7. AGE RESISTANCE exceptionally resistant to checking or cracking from exidation.
- to checking or cracking from exidation.

  8. HARDNESS RANGE—compounds can be varied from extremely soft to bone hard.
- NON-ADHERENT TO METAL—compounds will not adhere to motals even after prolonged contact under pressure. (Motal adhesions

Hyear Reg. U. S. Pat. Of.

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubbers



#### OUTPUT RAISER!

It puts a crimp in production to drive screws by hand . . . and then have to file off burrs. But that's what a certain washing machine maker had to do as long as he used slotted screws inside his tanks.



#### COST AMAZER!

But when he changed to Phillips Recessed Head Screws, he eliminated burrs. And no longer having driver skids to worry about, he switched to power driving . . . upped output tremendously . . . and got truly amazing cost-savings.



#### TRAIL BLAZER!

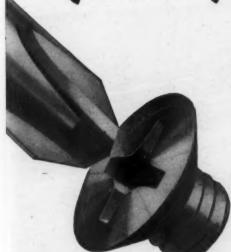
Besides reducing costs and speeding up production, use of Phillips Screws also shows up in product strength and rigidity. Screws with the Phillips Recess help designers plan . . . and get . . . much stronger, tighter fastenings.



#### COMPETITION FAZER!

Here's the final place where Phillips Screws give you an edge on competition. Any product with these better-looking, burr-free fastenings . . . that never disfigure surfaces or snag clothing . . . is just that much easier to sell!

# It's Phillips.... the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

... It's the exact pitch of the angles that eliminates driver skids.

... It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

... It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% - cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

# PHILLIPS Recessed SCREWS

WOOD SCREWS . MACHINE SCREWS . SELF-TAPPING SCREWS . STOVE BOLTS

24 RUES

American Screw Co., Providence, f., l.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
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Stabilized Trucks

Stabilized Trucks

Add to the life of equipment
lading damage

Selected for 92,000 Cars

and prevent lading by 55 Railroads and
Private Car Lines



STANDARD CAR TRUCK COMPANY
332 SOUTH MICHIGAN AVENUE CHICAGO 4, ILLINOIS



• If your product requires brackets for assembly, why not use brackets with self-locking nuts built right in them? Why fumble around with separate lock washers and threaded nuts and use a wrench besides to keep them from turning? Why handle 9 parts (bracket, 2 screws, 2 lock washers, 2 nuts, screw driver and wrench), when 4 parts will do a better job? (SPEED NUT, 2 screws, and screw driver). Think of the savings in manhours and materials this could mean in your plant!

These SPEED NUTS lock with a firm spring tension that permanently prevents vibration loosening. They

reduce weight, speed up assembly, and strengthen the structure. And since they are produced on high speed automatic machines, these self-locking brackets are not expensive.

Hundreds of manufacturers have improved both their products and assembly methods by changing over to Tinnerman angle brackets. Write for samples, mentioning part numbers of the type that interests you most.

TINNERMAN PRODUCTS, INC. 2029 Fulton Road, Cleveland 13, Ohio

In Canada: Wallace Barnes Co., Ltd., Hamilton, Onlario In England: Simmonds Aerocessories, Ltd., London



THE BASIC PRINCIPLE of Spring-Tension Lock is Embodied in all Speed Nut Designs



A6264

# A Constant Level of Illumination With Fluorescent Lamps is Desirable

By keeping voltage and frequency variations within reasonable limits for all values of DC input voltages, a constant level of illumination is maintained.

This greatly enhances the advantages of Fluorescent Lighting, and assures maximum lamp life.

INHERENT
VOLTAGE AND
FREQUENCY
REGULATION

TYPE MG-15
MOTOR ALTERNATOR

Since the first application of Fluorescent Lighting to a railway car, the SAFETY Motor Alternator has been the accepted standard means of conversion from DC to AC.



THE SAFETY CAR HEATING and LIGHTING COMPANY, INC.
NEW YORK - CHICAGO - SAN FRANCISCO - PHILADELPHIA - BOSTON - ST. LOUIS - MONTREAL



# Dissipate THE SHOCKS!



For several years now Spring Groups have been hard-pressed by the perpetual pounding of unprecedented loads and speeds. Dissipating these greatly-augmented shocks on many cars are Holland Volute Snubber Springs.

Uncle Sam Uses Volute Springs on Many Tanks

MICHIGAN AVENUE, CHICAGO, ILLINOIS Signal Corps Photo

# Dependable Performance

always with

# P-G Steel Grid Resistors

The widespread acceptance of P-G
Steel Grid Resistors is the direct result of
outstanding records for constant dependable
performance. Service records are created
by use of durable materials in unique
and exclusive design to produce resistors able to easily meet the most
exacting requirements. Always
specify P-G for continuous

Trouble-Free performance.

- + ALL STEEL CONSTRUCTION
- \* MICA INSULATION
- + BUGGED TERMINAL
- \* PROVISION FOR EXPANSION
- \* ADEQUATE VENTILATION
- \* UNAFFECTED BY VIBRATION
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- \* CORROSION PROTECTED

Detailed information in BULLETIN No. 500

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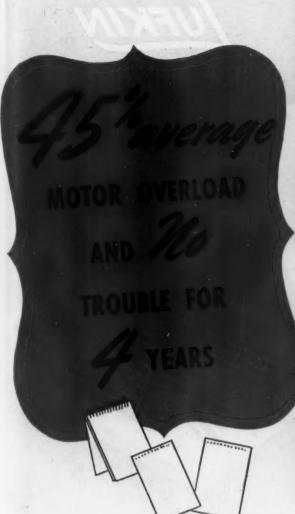


The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

· ESTABLISHED 1892 ·

221 WEST THIRD STREET, CINCINNATI, OHIO



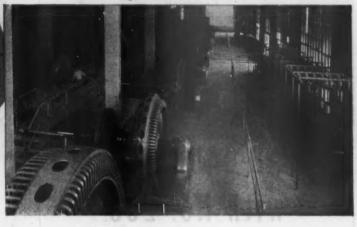


**Powerful Electric Shovel** 



Rock Crushers with 100 HP Synchronous Motors

Ball Mills with 400 to 900 HP Motors



### **ELECTRICAL MAINTENANCE SUCCESS STORY**

Motor maintenance, as we see it, means much more than simple replacement of parts which fail. It means taking into account the causes of failure and guarding against them. The result, as shown throughout the large plant in which the photos above were taken, is rotating electrical equipment better suited to its task than it was when it was originally installed. The typical National electrical maintenance success story is really one of improved performance, not merely maintenance.

Examples in this one plant: A motor, rated at 40 horsepower but carrying a 58 horsepower load (45% overload) failed time after time with ordinary windings. In 1940 National Mica-Glas coils were installed; there has been no shut-down since

that time because of electrical failure.

Two generators had to be wound about twice a year. National redesigned the windings to meet the special conditions five years ago; there has been no trouble since. (See top photograph above.)

One hundred horsepower synchronous motors, with flywheels (see middle photograph above), 400, 500 and 900 horsepower motors on ball mills (see bottom photograph above) and other electric power units throughout the plant deliver better performance because of National replacement coils.

Up-to-the-minute National plants, experienced engineering and a record of accomplishment second to none are ready for any problem involving the redesign or repair of your rotating electrical machines.





# CUT 8-GAUGE STEEL with No. 208 STANLEY UNISHEAR

Steel and brass mills, shipyards, heavy sheet fabricating shops, tank shops, railroad shops and others use Stanley No. 208 Unishears on the heavy production jobs as well as in their maintenance and repair divisions.

A one-man portable electric shear that cuts up to 10 feet per minute—makes straight or curved cuts. Easily suspended when job requires it. Maximum capacity 8 gauge (.171" thick) hot rolled steel. Write for complete details. Stanley Electric Tools, Division of The Stanley Works, New Britain, Connecticut.

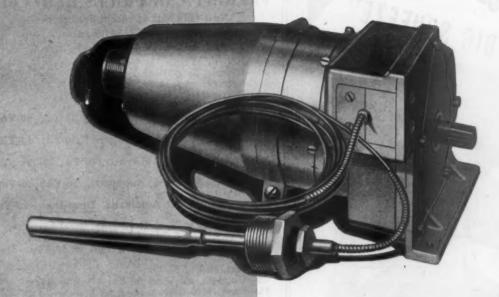




# STANLEY UNISHEARS



# BARBER-COLMAN



HIGH TORQUE-WEIGHT RATIO

SELF-CONTAINED
REMOTE BULB
ACTUATING ELEMENT

PROPORTIONING CONTROL

STABLE OPERATION

WIDE RANGE OF APPLICATIONS

ACCURATE, DEPENDABLE

# POWER UNIT

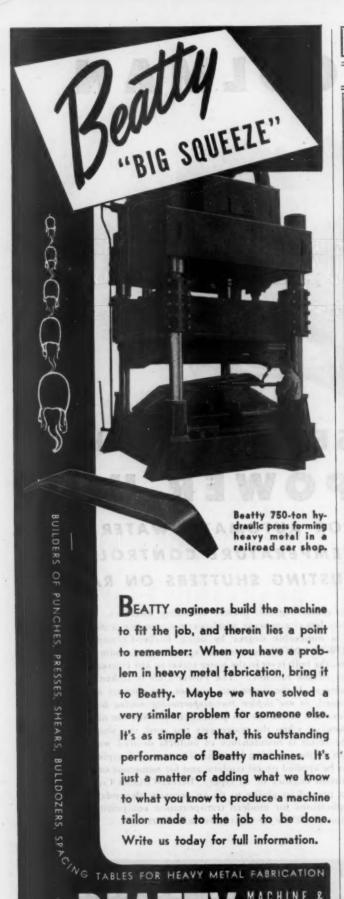
FOR AUTOMATIC WATER OR OIL TEMPERATURE CONTROL BY ADJUSTING SHUTTERS ON RADIATOR

On diesel engines, greater operating efficiency, lower operating costs, less engine wear, and lower maintenance costs can be achieved to a noticeable degree by using Barber-Colman Self-Contained POWER UNITS. For instance, on control of cooling water temperature, the bulb is set in the water jacket or any convenient place in the line or the radiator. The Power Unit is linked to the radiator shutters. If the water gets too hot, the shutters are automatically opened, in one stepless true-proportioning motion without overrun or "bunting", to the correct position to provide the necessary cooling. Likewise, when the water gets too cool, the shutters are closed. The result is maintenance of uniform desired water temperature, with all the resulting benefits. The same principle of arrangement can be applied on oil coolers, and for numerous other purposes on railroad engines of all types. Barber-Colman Control equipment has proved its ability to do an accurate, dependable job in many applications for modern transportation equipment. Learn more about it. Write for descriptive bulletins today.

BARBER-COLMAN

COMPANY

ROCKFORD . ILLINOIS



#### GET TOGETHER DEPARTMENT

#### FOR SALE

#### FREIGHT CAR PRICES REDUCED!

Now only half of recent peak prices! \$500.00 to \$4250.00 each!

Which of these cars could you use?

40—Hopper, Triple, 50-Ton 50—Hopper, Side-Discharge, 50-Ton 80—Refrigerator, 40-Ft., 40-Ton 16—Refrigerator, 36-Ft., 30-Ton

-Box, 40-Ft., 40-Ton

-Dump, Western, Automatic, 30-Yd., 50-Ton;

lift doors.
-Dump, Western, Automatic, 30-Yd., 50-Ton; lift doors. 10-

-Dump, Mogor, Automatic, 30-Yd., 50-Ton; lift

Dump, Western, Automatic, 30-Yd., 50-Ton; lift doors

1—Dump, Koppel Automatic, <u>Drop-Door</u>, 20-Yd.,

Gondola, 50-Ton, High-Side, Steel
-Dump, K & J, Automatic, 16-Yd., 40-Ton
-Dump, Western, 20-Yd., 40- & 50-Ton; Steel Floors

20—Flat, 40-Ft., 50-Ton
70—Gondola, all steel 40-Ft., 16 drop doors.
30—Tank, 8000-Gallon, 40- & 50-Ton
10—Tank, 10,000-Gallon, 50-Ton

Perhaps this list also has some other cars you could use to very beneficial advantage now!

All cars are priced to sell!

IRON & STEEL PRODUCTS, INC. 40 Years' Experience

13478 S. Brainard Avenue Chicago 33, Illinois

"ANYTHING containing IRON or STEEL"

### PAPER HELPS FINISH THE JOB

Don't take paper for granted. Waste paper used to be as common as air or grass. Today it must be conserved as a raw material for the manufacture of new paper and paperboard.

Paper packages, medical and food supplies for liberated peoples, for armies of occupation and for the fighting forces everywhere. Every article. going overseas . . . each tiny



Your wastebasket scraps can help supply ckaging materi als—if you make sure they are collected.

surgical needle and instrument part . . . every tank or plane . . . is made, wrapped or tagged with paper. Your waste paper is a basic raw material for that war paper.

Wastebasket scraps, brown corrugated cartons, brown wrappings or bags, old newspapers and magazines . . .

all should be saved, collected and put to work again.



MFG. COMPANY

MMDND

U. S. Victory Waste Paper Campaign



• This Wells No. 8 Metal Cutting Band Saw has proved itself a handy tool to have in any man's metal working plant. Sturdily made, simply designed, it keeps cutting-most all shapes and types of metals - wherever you need it. It frees large production units for other work. It outs close - removes a minimum of stock and operators like it because it's easy to use. Then, too, this Wells is portable. You save time and labor by moving the saw to the work. Check up. You'll find a spot in your plant for a Wells No. 8. See your supply distributor for details.



Products by Wells are Practical

SPEEDS:

WEIGHT

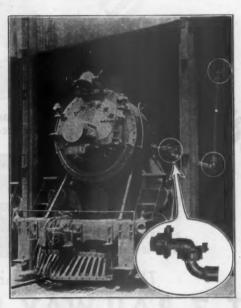
Selective 60, 90, 130

feet per minute

Approximately 750 pounds

# FLEXO JOINTS

make pipe flexible



Locomotive blower line made up of pipe and FLEXO JOINTS. Quickly and easily connected or disconnected.

### FLEXO JOINTS

are dependable. It makes no difference how hard the service may be — with high or low pressure steam, air, all, hat or cold water — you can always depend on FLEXO JOINTS. They have proven their ability to give unsurpassed service and the first cost is quickly repaid by savings and increased efficiency.

Mode of bronze for hard usage and lots of it — the life of FLEXO JOINTS is indefinite and they are as simple as they are efficient; no springs to lose or ground surfaces to wear. All moving parts are entirely enclosed and fully protected from dirt and grit.

Install them in pipe lines that are moved or swung in different directions or on machinery or equipment that must be supplied with any fluid while in motion.

4 styles - pipe sizes from 1/4 inch to 3 inches. All pressures to 1350 lbs. superheated steam.

Get the details, then order from your regular supply house or direct from

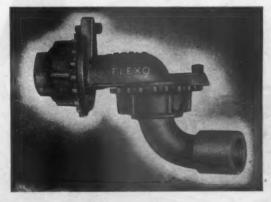
FLEXO SUPPLY COMPANY, Inc.

4223 OLIVE STREET

ST. LOUIS (8) Mo.

S. A. ARMSTRONG, LTD. IN CANADA

TORONTO (5)



Car Specialties



All Standard Type Spring Plates produced for your requirements.

by Motor Wheel

POSSIBLE DAMAGE TO ENGINES

DELAYS

M

Defect Card Holders made of heavy gauge, pressed steel construction.



Weatherproof. Large opening for convenient access.

The Above Equipment Fully Meets A.A.R. Requirements

### T-Z RAILWAY EQUIPMENT CO., Inc.

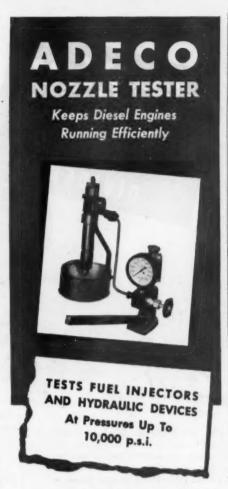
8 SO. MICHIGAN AVE.,

CHICAGO 3, ILL.

National Railway Sales Representative

Motor Wheel Corp., Lansing 3, Mich.





To keep diesel engines operating at peak efficiency, this portable, precision-built Adeco Nozzle Tester is indispensable.

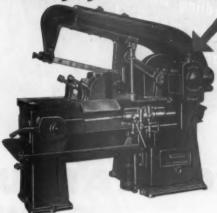
Light in weight yet built for heavyduty service, it enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Tests both large and small injectors, on bench or engine, at pressures up to 10,-000 p.s.i. Prevents costly delays and possible damage to engine.

Ideal for testing hydraulic devices.

Write for bulletin on this practical, low-cost unit.



# DUAL FEED . and why you need it



MODERN METAL WORKING PRACTICE requires proper application of the cutting tool. In RACINE Machines "Dual Feed," hydraulically controlled, provides two distinct cutting actions for materials of varying area and hardness.

RACINE's exclusive "Dual Feed" consists of Positive and Flexible Feed, progressively applied — hydraulically controlled. Round bars, odd shaped pieces, tubing and free cutting stock require a compensating type of feed for maximum cutting efficiency. RACINE'S "Flexible Feed" automatically picks up speed as the resistance to the blade decreases. You benefit by increased output.

Under "Positive Feed" the teeth of the blade are forced beneath the surface of the stock. This positive feeding action is essential to efficient, accurate cutting of high speed steel and other hard, tough materials. With "Positive Feed" on your RACINE Machine, all cuts are made in exactly the same time, predetermining production.

A nationwide organization of competent, experienced machine tool dealers sells and services RACINE Machines. Send us an outline of your cutting problems. Our dealers and factory engineers will make up recommendations without cost to you. Free Catalog No. 12 will be included. It briefly describes the various machines in capacities from 6" x 6" to 20" x 20". Write today.

#### comparison proves

- \* The Racine Machine line is complete all capacities from operate, rugged and long lived.

  6" x 6" to 20" x 20".
- ★ Special designs are available for special jobs. Sawing is cheaper than milling.
- \* Service and sales facilities available everywhere. Deal with trained and experienced ma-

#### RACINE "VARIABLE VOLUME" PUMPS-

#### A MODERN SOURCE OF HYDRAULIC FORCE

Oil Hydraulic Power from 50 to 1000 lbs. P.S.I. Variable Volume from zero to 30 G.P.M. Use RACINE Pumps on your new designs and apply them to existing circuits. Let our hydraulic division engineers explain the advantages of hydraulic operation and control for your products. RACINE TOOL AND MACHINE COMPANY, 1740 State St., Racine, Wis., U.S.A.



The Production Saws of Modern Industry



If it pays you to have over-head cranes, conveyors or factory trucks, you'll find your versatile Roustabout Crane highly profitable outside their range - for moving, loading, stacking heavy stuff all around your plant. Instantaction where needed -no crewstaken from other work. Smooth easy operation - picks up a 71/2 ton machine or sets down a crate of eggs safely. Built for years of overwork - ball-bearing boom turntable, gears in oil. Hundreds of plants regard their wheel or crawler Roustabouts as indispensable. Write for complete facts.

Roustabout saves you time and money on these and many other jobs

- Big stuff off and on trucks, freight cars
- Moving large machines
- Handling bales, boxes, drums
- Moving big castings, motors, railroad and marine gears
- Loading air transport
  planes
- e Handling tanks, pipe, structural steel
- Installing heavy valves and fittings



The EDNA Positive Oil Feed Divider now makes possible far greater efficiency in automatic division and distribution of lubricants to all machinery points. Multi-Feed Dividers eliminate the number of active lubricator feeds required, reduce the quantity of pipe needed for any application. Lubricant flows freely up to 10,000 lbs. pressure per square inch! And in extremely cold weather operates with complete efficiency. Priced from \$17.50 to \$43.50. For further details and list of railroads now using Edna Dividers, write for Bulletin No. A-101A.

REPAIRS

HON

CLEANING

NOT GENERALLY REQUIRED

INSPECTION

NONE

MAINTENANCE

NONE

#### POSITIVE

Dependable operation, Works against steam or atmospheric pressure.

#### **FLEXIBLE**

Available in unlimited number of practical combinations to divide and deliver lubricants to any points and in any quantities.

#### **ECONOMICAL**

Because of high quality of materials and simple design, requires no maintenance. Initial cost is last cost.

(Y

FORCE FEED LUBRICATORS

"POSITIVE" OIL FEED DIVIDERS

AUTOMATIC AUXILIARY LUBRICATORS

HYDROSTATIC LUBRICATORS • OIL CUPS

LIFTING and NON-LIFTING INJECTORS • BOILER CHECKS

VALVES • COCKS: CYLINDER — GAUGE — TANK

REFLEX WATER GAUGES • WATER COLUMNS

"EDNALOY" CASTINGS

THE EDNA BRASS MFG. CO.

Sales Agent of National Lead Company

525 READING ROAD

CINCINNATI 2, OHIO





## C-F POSITIONERS



CULLEN - FRIESTEDT

1324 S. Kilbourn Ave.,

# Production Welding will be automatic on C-F Positioners

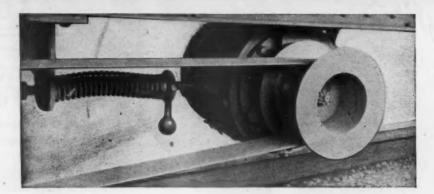
Wartime advancement in automatic welding makes certain its wide use as a standard production method in postwar manufacturing. As now, much of it will be done on C-F Positioners, because: (1st) They permit a down hand weld on all sides with but one set-up,—rotate 360°, tilt to 135° beyond horizontal under push button control. (2nd) The exclusive C-F variable-speed drive which will give table rotational speeds from 0 r. p. m. up. (3rd) C-F positioners come in sizes and capacities for every weldment — are universal tools

equally efficient for job work or the production line.

> Write for Bulletin WP-22

COMPANY Chicago 23, U. S. A.

# VEELOS Balata BELTING



- Minimum Stretch
- High Coefficient of Friction
- High Tensile Strength
- Stronger Fastener Anchorage
- PROVEN Low Car-mile Cost

MFG. &

NEW YORK OFFICE MANHEIM, 50 Church St.

CHICAGO OFFICE 407 S. Dearborn Street

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reight AT FASTER SPEEDS

These critical war days, of heavier freight and faster speeds, call for equipment of greater efficiency. The new Baker Long Lap Locomotive Valve Gear delivers an increase in power with a decrease in steam consumption. This gear, with a travel of 9", makes possible a marked improvement in starting, and in the maintaining of higher speeds.

The Baker Valve Gear also comes in the Standard model, for travels up to 7½", and the Long Lap model, for travels from 7½" to 9". Baker Valve Gears are adaptable to all types of locomotives.



York, N.Y .- 310 S. Michigan Ave., Chicago, III.



# PERFECT THREADS

with surprising ease and speed

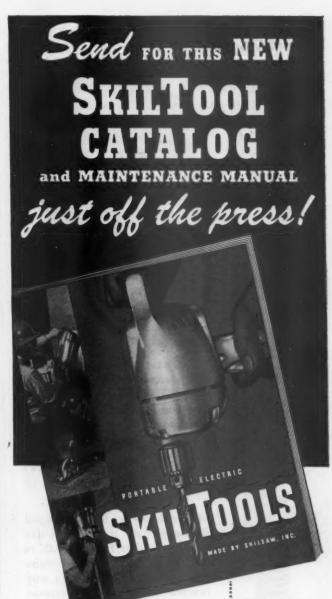
# with this self-contained RID No. 65 R

• No wonder the popularity of this threader has spread widely. The speed and ease with which it cuts clean perfect threads on 1" to 2" pipe are reasons enough. One set of high speed steel chasers threads all 4 sizes—and they set to pipe size in 10 seconds! Workholder sets instantly! You'll like other work-saver features of this rugged steel-and-malleable die stock—it pays you to try the self-contained No. 65R at your Supply House.



No. 65R stands up bandily when you want it to.





• Every owner, every operator of portable electric tools needs this manual to help make tools do their job better and last longer. The SKILTOOL Maintenance Manual in the SKILTOOL CATALOG is packed full of useful information on the care and economical use of all portable electric tools. Whether you use SKILTOOLS exclusively... or whether you also use other makes... you'll save money and delay the need for tool repair by reading and heeding the advice in the new SKILTOOL Maintenance Manual and Catalog. It's yours for the asking. Mail the coupon today!

Special Section on care and operation of Electric Tools, including:

DO'S AND DON'TS that help make tools (ast longer

CARE OF MOTORS, etc.

How to get the most from your portable electric tools

SKILSAW, INC., 5033-43 Elsten Ave., Chicage 30, Illinois Please sendfree copies of your new SKILTOOL Catalog with Special Tool Maintenance Section to:
Name
Address
CityState

ers

What does

CLEANING CURVED TUBES

mean to you?





Does it mean jamming of the cleaner when approaching curves—difficulty in negotiating short-radius bends—slowing up of tube cleaning in bends because of insufficient power difficulty in withdrawing the cleaner after traversing a curve? Many engineers encounter all of these problems.

Wilson, however, has developed a line of tube cleaners for use in curved tubes from 1" O.D. to the largest ever cleaned—tube cleaners that will go a long way toward helping you overcome these and other curved-tube-cleaning troubles.

Thomas C. Wilson's engineering staff is available for consultation on difficult or unusual tube cleaning problems. A 40 page bulletin describing the complete Wilson line—and a copy of the Wilson Tube Cleaners Check List will be sent on request.

Modern tubecleaners for the problems of today.



THOMAS C. WILSON Inc.

# Keep Your Red Cross at His Side -Give!

THIS is the most important appeal for funds in the history of the American Red Cross.

After three years of war the work of your Red Cross is greater than ever. It must serve millions of our fighting men abroad. Lonely men. Homesick men. Wounded men. The Red Cross, always at their side, helps to bring them cheer and comfort wherever they may be.

It lends a helping hand to the thousands of returning servicemen — sick, wounded — desperately in need of friendly guidance.

And remember, YOU.. and you alone.. keep the Red Cross alive. For without your help there could be no Red Cross. There are no special funds to keep up its great humanitarian work. The money must come, as always, from the heart of America—you!

Our duty is clear . . we must keep the Red Cross at the side of our fighting men and our wounded heroes. We must help the Red Cross in its vital job of sending food and medicine to war prisoners . . aiding the ill and lonely overseas . . collecting life-giving blood plasma. The scope of the Red Cross is almost limitless. Every Red Cross worker is your personal messenger of sympathy and comfort to your man in uniform.



GIVE NOW—GIVE MORE



# Permits Amazing Accuracy + SPEEO!

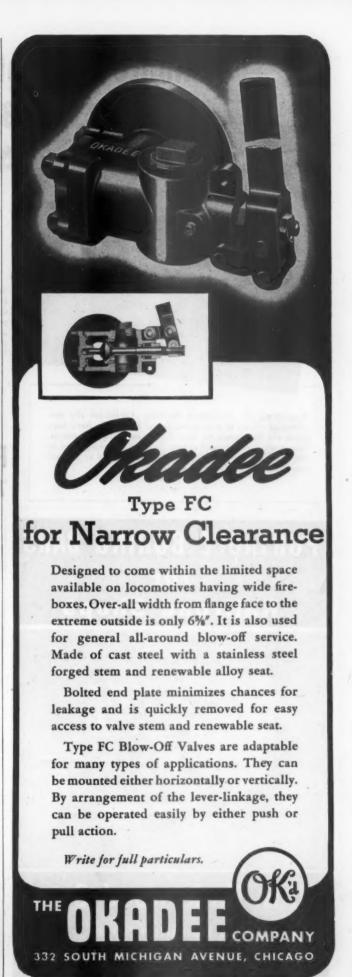
PLUG the leak in your "cutting off' costs! Use the new high speed Peerless Mechani-Cut Metal Sawing Machine for cutting off operations! It's fast — saws to close tolerances — cuts straight as a die! Exclusive Peerless design . . . new Mechani-Cut Compensating Feed Unit, Four-Sided Saw-Frame and Blade Backing-Plate will save you money in faster, more accurate sawing.

These precision-built Mechani-Cut Saws are available in 7", 11", and 14" capacities. Make sure you aren't overlooking a good bet! Write Peerless or call your local dealer today!

DEALERS IN ALL PRINCIPAL CITIES

Write Department RM-245





# 15 Minute Hydraulic Valve and Cylinder



APPLICATOR

For Locomotive Valve

BUSHING

# For Locomotive Valve and Cylinder Bushings

Equ

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PUNCHING

Will apply either cylinder or valve bushings in 15 minutes. . . . Portable, compact, lightweight, easily set up and operated by one man, it eliminates the need for heating cylinders and using power wrench. Consists of 60-ton capacity bushing applicator, and oil-operated, four-speed hydraulic hand pump, equipped with pressure-measuring gauge, accurately controlled and quickly read by operator. Applies both valve bushings simultaneously.

Also applies side rod busbings and driving box brasses.

In addition we manufacture the McQuade Cylinder Seat Surface Grinder and the McQuade Electric Tool Post Grinder.

R. J. McQUADE COMPANY 7734 S. Phillips Ave., Chicago 49, III.

Regarding the McQuade Bushing Applicator the mechanical officer of a large railroad says, "We have been using the McQuade for over a year in one of our roundhouses with an unusual saving in time. Bushings can be inserted in 15 to 20 minutes as compared to 3 or 4 hours insertion by the old hand method."

### PORTABLE BORING BARS for Railroad Shops



## H. B. Underwood Corp.

1025 Hamilton Street

Philadelphia 23

Pennsylvania

SPECIAL MACHINERY BUILT ON CONTRACT

THOMAS

BENDING AND STRAIGHTENING MACHINES • ANGLE BENDERS

Bending and Straightening Machines



A heavy rugged machine of steel plate construction, designed for all classes of bending and straightening operations. Available in various capacities from 50 tons to 400 tons.

Write for Bulletin 315

THOMAS
MACHINE MANUFACTURING COMPANY

PITTSBURGH, PA.



HIROHITO says "So Unhappy" when JUSTRITE is on the job!

That's because Safety Approved Equipment is the railroad's first line of defense against acci-dents and hazards of fire . . . that slow up the war effort.

#### THE NEW JUSTRITE SAFETY FLASHLIGHT

The light with an instant ap-The light with an instant appeal to railroad men. There's 1500 candlepower at the flick of the switch . . . 3 standard cells for dependable service. It fits in the palm of the hand, on belt clip, or will stand alone on a flat surface. This mighty midget has all the Justrite safety features "sealed-in" a plastic case. Approved for Safety by the Underwriters' Laboratories, Inc. and by the U. S. Bureau of Mines . . . your guarantee of Safety . . . Justrite.

Ask your supplier for price and specifications.



Model 17-S

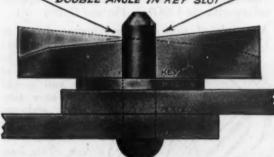
JUSTRITE MANUFACTURING COMPANY

2063 N. Southport Ave., Dept. D-8, Chicago 14, Illinois

# -New Process-

FOR "FITTING-UP" PURPOSES No Instructions Needed DRIVE KEY FROM EITHER SIDE

DOUBLE ANGLE IN KEY SLOT



Made from Steel of Special Analysis

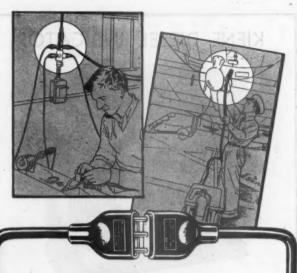
- Hold Tighter
- Last Longer

Cost Less

MSKAIG-HATCH INC.

MANUFACTURER

BUFFALO 7, N. Y.-U. S. A.



Water-Seal Cable Connectors Transmit Power to the Job Safely and Efficiently

Vines Cable Connectors are molded right on the rubber cable so that the connector becomes a part of the cable itself. The spring pressure female contact and the patented waterseal assure you a positive connection with the male connector for efficient power supply to any machine under all plant conditions.



#### For Any Portable Power Supply

Many types and sizes of Connectors have been developed, making them adaptable to almost any industrial application where power is transmitted by portable cable. Standard connectors are rated for loads to 600 volts.

Our engineers will gladly work with you in solving portable cable applications on capacities up to 5000 volts and 325 amps.

For efficient, safe, flexible power transmission by cable, use Mines Connectors-"The Connector with the Water-Seal."

WRITE FOR BULLETIN MC-106, showing many successful applications of Mines Connectors throughout industry.

#### MINES EQUIPMENT COMPAN

4280 Clayton Road St. Louis 10, Missouri

#### KIENE DIESEL INDICATOR



QUICK AND ACCURATE TESTING OF COMPRESSION AND FIRING PRESSURES ON DIESEL SWITCHERS AND ROAD LOCOMOTIVES

- No Pistons No Springs No Synchronizations Only One Moving Part
  Simple and Rugged Construction
  Easy to Use No Experience Necessary
  Compact Light in Weight Low in Cost

APPROVED FOR USE BY U. S. NAVY

Write for descriptive bulletin

#### KIENE DIESEL ACCESSORIES, INC.

380 LEXINGTON AVE., NEW YORK 17, N. Y. Factory and General Offices: 5334 AINSLIE STREET, CHICAGO 30, ILL.

### INDISPENSABLE FOR EVERY RAILROAD SHOP AND SER-VICE DEPARTMENT

**JONES** MULTIPLE-RANGE HAND **TACHOMETER** 



Jones Tachometers give an instant and accurate check on RPM, operating speeds on engines, motors; for checking shaft speeds on rotating parts, both for RPM, feet per minute and other special connections. Continuous indicating, guaranteed calibration. Multi-range portable hand tachometer shown is lightweight and heavy-duty...300-12,000 R.P.M. Complete with 4" extension rod, curvex and concave rubber tips, 12" peripheral disc, center punch and carrying case...\$60.00 f.o.b., Stamford, Conn.

### JONES MOTROLA CO

434 FAIRFIELD AVE.

STAMFORD, CONN.



The MAHR Triple Atomizing Burner is the secret of the fast and efficient heating performance of MAHR Rivet Forges. It gives a steady, soaking heat that is clean and smokeless—no oil drip or carbon deposit.

Here's economy, too! The power cost for compressed air is about 5 times greater than for low-pressure fan or blower air used by MAHR Rivet Forges. With low pressure air, the fire brick lasts from 331/8% to 50% longer.

ASK FOR **BULLETIN 175**  on MAHR gas or Oil Fired Rivet Heaters, or bulletins on smithing forges, locomotive fire lighters, tire heaters, stress relief furnaces, flue annealing furnaces.

Sales Offices in Principal Cities



#### MANUFACTURING CO.

Division of Diamond Iron Works, Inc. 1710 NORTH SECOND STREET, MINNEAPOLIS 11, MINN.

### Greater SAFETY For a Lower Cost

WHY take chances with ordinary cotters— VV especially since the speeds of all trains have been increased?

Every application on a car, locomotive or any other moving vehicle can be made in absolute safety with the COOKE Pin and Cotter.

A couple of taps with a hammer drives the COOKE Cotter into place. It is securely locked in

one operation-and it will stay there until removed. It is easily and quickly applied. You save time, money and promote maximum safety.

Note: This wedge opens, spreads and locks the cotter, thereby elimi-nating vibration and wear.

PIN and COTTER

American Railway Products Co. 162 Post Road, Darien, Conn.

### Serving RAILROADS

Car and Locomotive Builders

OVER 30 YEARS

"NEW PROCESS"



**PUNCHES** DIES RIVET SETS

Made from tough high grade, wear resistant ALLOY Tool Steel to assure longer service life.

GEO. F. MARCHANT CO. 1430 S. ROCKWELL ST., CHICAGO, 8 ILL.

AWOL

### when JUSTRITE is on the job

Justrite Oily Waste Cans and Justrite Safety Cans . . for pouring, handling and storing of flammable liquids are standard safety equipment with many railroads ... for they're approved for safety ... Justrite.

#### THE JUSTRITE OILY WASTE CAN

A safe container for oily waste, rags or other flammable material. Cuts fire hazards to a minimum. Equipped with foot lever if desired . . . closes automatically. A safe, economical, efficient can now available in a wide range of sizes.

Each can is inspected and individually numbered and labeled by Underwriters' Laboratories, Inc. and by the Associated Factory Mutual Fire Insurance Companies . . . for your protection . . . Justrite.

Ask your supplier about the complete line of Justrite Safety Products.



#### JUSTRITE MANUFACTURING COMPANY

2063 N. Southport Ave., Dept. D-8, Chicago 14, III.

### ARMSTRONG DROP FORGED SETTING-UP TOOLS





Especially now, with skilled labor scarce and double production schedules to meet, there's no time to pick over the scrap pile searching for makeshift setting-up tools.

Cut setting-up time to a fraction and prevent accidents and spoilage by providing each machine tool with a complete set of ARMSTRONG Settingup Tools including: Drop Forged Strap Clamps (6 types), Planer and Bracing Jacks and T-Slot Bolts each in many sizes.

Write for Catalog C-39a.

ARMSTRONG BROS. TOOL CO. "The Tool Holder People"

124 N. FRANCISCO AVE. CHICAGO, U.S. A.
Ecstern Warehuuse 4 Soles, 199 Lafayette 51 New York



• This fastener has established the

open-end cross-woven fabric V-belt as a drive with many advantages over both flat belts and endless V-belts for many railway services. The exclusive separable hinge joint of Alligator V-belt Fasteners saves time ad makes it possible to quickly and easily install or remove the V-belts.

The fasteners are available in B, C, D and 1" sizes; also a 2" fastener for use on both lug and solid type V-belts.

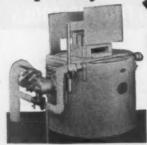
Many roads are now using Alligator V-belt Fasteners. If you are not familiar with this latest development in V-belt fastening you should write for Bulletin V-205.

Order from your supply bouse

#### FLEXIBLE STEEL LACING CO. 4694 Lexington St., Chicago 44, Illinois

Also sole manufacturers of Alligator Steel Belt Lacing for flat transmission belts and Flexco HD Belt Fasteners and Rip Plates for fastening and repairing conveyor belts.

#### Specify



### **JOHNSTON**

OIL BURNING

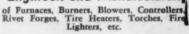
### BLACKSMITH FORGES

for Greater Production, Lower Costs

Equipped with JOHNSTON REVERSE BLAST Low Pressure Burners—great atomizing power, full air pressure on atomizer at all times, oil and air thoroughly mixed. Start with full fire instantly without smoke. Fire adjusted quickly. Eliminate handling of coal and ashes. Shields and curtain pipe protect operator from heat. All steel construction. We'll help you convert coal burning forges to oil.

JOHNSTON LOW PRESSURE BLOWERS can be furnished to supply the air to burner and air curtain pipe for one or more of these forges. Write for full details.

#### Engineers and Manufacturers JOHNSION





# JOHNSTON MANUFACTURING

1825 EAST HENNEPIN AVENUE . MINNEAPOLIS 13, MINNESOTA

# KING LUBRICATOR

Model No. 36
For Locomotive Air Compressors



Provides entirely automatic lubrication to steam and air cylinders. Starts when compressor starts and stops when compressor stops. Has separate reservoirs for steam cylinder and air cylinder oils. May be adjusted to a wide range of feeds. All working parts in a constant bath of oil. No ratchet mechanism.

THE U. S. METALLIC PACKING CO. PHILADELPHIA 23, PENNSYLVANIA

IN LOCOMOTIVE CONSTRUCTION and MAINTENANCE

# 'BESTOLIFE

- · INCREASES EQUIPMENT EFFICIENCY
- . SAVES REPAIR TIME HOURS
- · REDUCES NUMBER OF REPLACEMENT PARTS

BESTOLIFE Lead Seal Joint Sealing and Anti-Seize Compound keeps locomotive joints sealed, and studs and staybolts tight while in service, yet allows them to be easily disassembled when desired. Used with boiler connections, fireboxes, smokeboxes, super-heater units, steam and exhaust piping, valves, pumps, injectors, washout plugs, etc., 'BEST-OLIFE increases efficiency, saves repair time hours and reduces replacement costs. It provides leak-proof joints on steam, air, water and oil lines. Applied easily with a brush and

Manufactured Exclusively by

does not deteriorate.

# I. H. GRANCELL

1601 EAST NADEAU STREET LOS ANGELES 1, CALIFORNIA



# Screw Machine Parts

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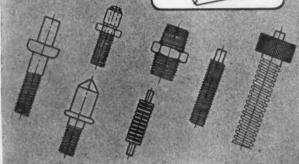
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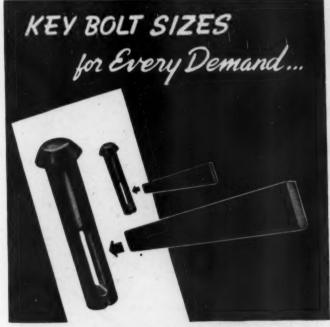
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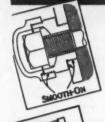




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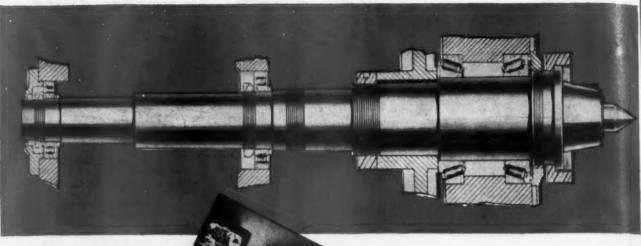
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